

**City of Key West**

# **Greenhouse Gas Emissions Inventory Report**



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## ***Table of Contents***

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<b><u>Executive Summary</u></b> .....	3
<b>I. <u>Introduction</u></b> .....	4
A. Introduction to Climate Change Science .....	4
B. Effects & Impacts of Climate Change .....	5
C. Action Being Taken on Climate Change .....	9
D. ICLEI and the Cities for Climate Protection Program .....	12
<b>II. <u>Greenhouse Gas Emissions Inventory</u></b> .....	
A. Methodology .....	14
1. CACP Software.....	14
2. Inventory Sources and Creation Process.....	15
B. Emissions Inventory Results.....	16
1. Municipal Emissions Profile.....	19
2. Community Emissions Profile .....	27
C. Forecast and Target.....	31
1. Community Emissions Profile .....	31
2. Municipal Emissions Profile.....	33
<b>III. <u>Conclusions and Next Steps</u></b> .....	34
A. CCP Milestone Process.....	34
B. Developing a working Climate Protection Task Force for Key West .....	38
<b>IV. <u>Appendices</u></b> .....	41
A. List of Figures & Tables .....	42
B. Glossary of Terms.....	43
C. Information Sources .....	47
1. Community Inventory.....	47
2. Municipal Inventory.....	51
D. Assumptions/Calculations.....	53
1. Community Inventory.....	53
2. Municipal Inventory.....	56
E. CACP Software Reports .....	59
1. Community GHG Emissions - Time Series Report.....	60
2. FY05 Community GHG Emissions by Subsector.....	61
3. FY05 Community GHG Emissions by Source .....	62
4. FY05 Government GHG Emissions by Subsector.....	63
5. FY05 Government GHG Emissions by Source .....	64
6. FY05 Community CAP Emissions .....	65
7. FY05 Government CAP Emissions .....	66
8. 2015 Community GHG Emissions Forecast.....	67

## ***Executive Summary***

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The debate is over. The overwhelming scientific consensus is that human-induced climate change is among the most pressing environmental problems facing this generation and those to come.

**The time to act is now.** Never in the past 1000 years has the planet warmed at a faster rate than during the 20th century, and the most recent decade has been the warmest ever on record. Allowing this trend to continue could result in increased catastrophic weather events such as hurricanes, forest fires, drought and floods; degradation of eco systems and wildlife; decreased agricultural output; and displacement of entire populations due to rising sea levels. As a coastal community living only a few feet above sea level, Key West is extremely vulnerable to the potential consequences of climate change.

**Key West must do its part.** Although the United States accounts for a mere 4% of the world's population, it produces 25% of the world's greenhouse gases. Key West released nearly 400,000 tons of greenhouse gas emissions (CO<sub>2</sub>e) in fiscal year 2004-2005 and is projected to emit 4.3% more in 2015. However, on August 7, 2007, the Key West City Commission voted unanimously to become the first municipality in Monroe County to become a member of ICLEI – Local Governments for Sustainability, and to join over 350 cities and counties nationwide that have made a commitment to embark on ICLEI's 5-Milestone *Cities for Climate Protection (CCP) Campaign*. The Commission took this bold step in recognition of the fact that the effects of global climate change will have a severe impact in the Florida Keys, and that local governments can and must play a part in implementing solutions and measures to reduce our carbon footprint. In so doing, we have committed to ICLEI's Five Milestone Process to combat global warming:

- Milestone 1: Conduct a baseline emissions inventory and forecast
- Milestone 2: Adopt an emissions reduction target
- Milestone 3: Develop a Climate Action Plan for reducing emissions
- Milestone 4: Implement policies and measures
- Milestone 5: Monitor and verify results.

**We have the opportunity to make Key West a model community.** The city is committed to reducing its contribution to global climate change by taking local action to reduce greenhouse gas emissions. To do so we must focus on getting the entire community engaged and keeping it involved. Municipal leadership is an imperative step, but significant change will require the participation of the community as well. City government actions will serve as a catalyst for that participation, by leading the way and setting an example.

# I. Introduction

## A. Introduction to Climate Change Science

### Global Warming: the facts are in

Global warming -- a gradual increase in planet-wide temperatures -- is now well documented and accepted by scientists as fact. A panel convened by the U.S National Research Council, the nation's premier science policy body, in June 2006 voiced a "high level of confidence" that the Earth is the hottest it has been in at least 400 years, and possibly even the last 2,000 years. Studies indicate that the average global surface temperature has increased by approximately 0.5 - 1.0°F (0.3 - 0.6°C) over the last century. This is the largest increase in surface temperature in the last 1,000 years and scientists are predicting an even greater increase over this century. Eleven of the last twelve years (1995-2006) rank among the twelve warmest years in the instrumental record of global surface temperature (since 1850).<sup>1</sup> This warming is largely attributed to the increase of greenhouse gases (primarily carbon dioxide and methane) in the Earth's upper atmosphere caused by human activities: burning of fossil fuels, industrial activities, farming, and deforestation.

The basics of global warming can be summarized as follows. Energy from the sun enters the atmosphere as light, and heats the earth's surface. The heat is radiated back into space, especially at night. Atmospheric greenhouse gases naturally present in the atmosphere trap some of the outgoing energy, retaining heat somewhat like the glass panels of a greenhouse and prevent an extreme dip in temperature. The earth normally sheds heat into space at approximately the same rate it absorbs the energy from the sun. This process is depicted in Figure 1 below.

### The Greenhouse Effect

Problems arise when the atmospheric concentration of greenhouse gases increases and upsets the equilibrium of these gases naturally present in the atmosphere. Global warming refers to the increasing warming of the earth because of the increase in greenhouse gases in the atmosphere.

Scientists believe that the burning of fossil fuels, the destruction of forests and other human activities are the primary reason for the observed increased concentration of carbon dioxide in the atmosphere. Energy burned to run cars and trucks, heat homes and businesses, and power factories is responsible for about 80 percent of society's total carbon dioxide emissions. Human industrial activities annually emit the equivalent of 8.3 billion tons

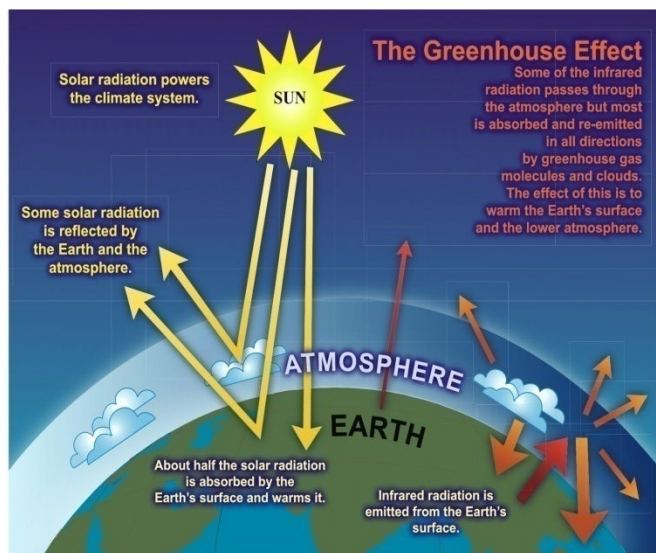


FIGURE 1: THE GREENHOUSE EFFECT

<sup>1</sup> IPCC Fourth Assessment Report "Climate Change 2007: The Synthesis Report"

of carbon dioxide into the atmosphere. Trees, plants, and oceans reabsorb 60 percent of this carbon. However, the remaining 40 percent increases the atmospheric level of greenhouse gases, magnifying the planet's natural warming mechanism and increasing temperature worldwide.

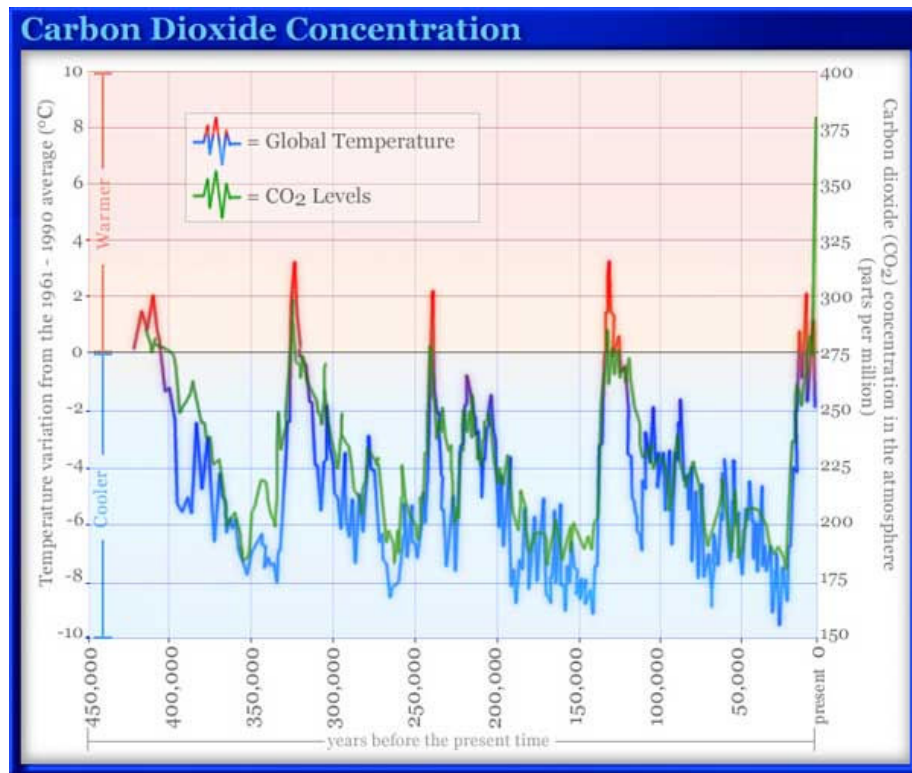


FIGURE 2: IMAGE BASED ON DATA FROM NOAA

Over the past 425,000 years, cool periods have coincided with times when the CO<sub>2</sub> concentration in the atmosphere was lower. When there is less CO<sub>2</sub> in the atmosphere, the greenhouse effect is reduced and the world cools, as depicted in Figure 2 above.

## B. *Effects & Impacts of Climate Change*

Average global temperatures may increase by 2.4 - 6.4°C (that's 4.3 - 11.5° F) by the end of the 21st century.<sup>2</sup> Although the numbers sound small, they can trigger significant changes in climate. (The difference between global temperatures during an Ice Age and an ice-free period is only about 5°C.)<sup>3</sup> Besides resulting in more hot days, many scientists believe an increase in temperatures may lead to changes in precipitation and weather patterns. Warmer ocean water may result in more intense tropical storms and hurricanes. Sea levels are also expected to increase by 0.09 - 0.88m (0.3 - 2.9 feet) in the next century, mainly from melting glaciers and expanding seawater. Global warming may also affect wildlife; species that cannot survive in warmer environments may become

<sup>2</sup> Global Climate Projections. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

<sup>3</sup> Stanford Solar Center, 2007.

extinct. Finally, human health is also at stake, as global warming may result in the spreading of certain diseases such as malaria, the flooding of major cities, a greater risk of heat stroke for individuals, and poor air quality.

The Intergovernmental Panel on Climate Change (IPCC), co-recipient of the 2007 Nobel Peace Prize, has re-confirmed in its most recent Fourth Assessment Report of November 17, 2007 that human-induced climate change is indeed a reality. It can no longer be dismissed as a theoretical, academic concept. Over 2,500 of the world's most renowned climate science experts have concluded the following:

**“Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level.”<sup>4</sup>**

If we want a real chance of keeping the global average temperature from exceeding 1.1°C (2° F) above 2000 levels – an important threshold to prevent complete melting of the Greenland ice sheet and other dangerous climate impacts – we must stabilize the atmospheric concentration of carbon dioxide at 450 ppm (parts per million) or lower (Figure 3.) In order to stabilize at 450 ppm, global emissions of greenhouse gases must begin to decline by 2020, reaching one-half their current levels by 2050 and one-quarter of current levels by 2100. Because the United States contributes over one-fifth of total global emissions with only one-twentieth of world population, U.S. emissions would have to decline 80 percent by 2050 in order to meet these goals.<sup>5</sup>

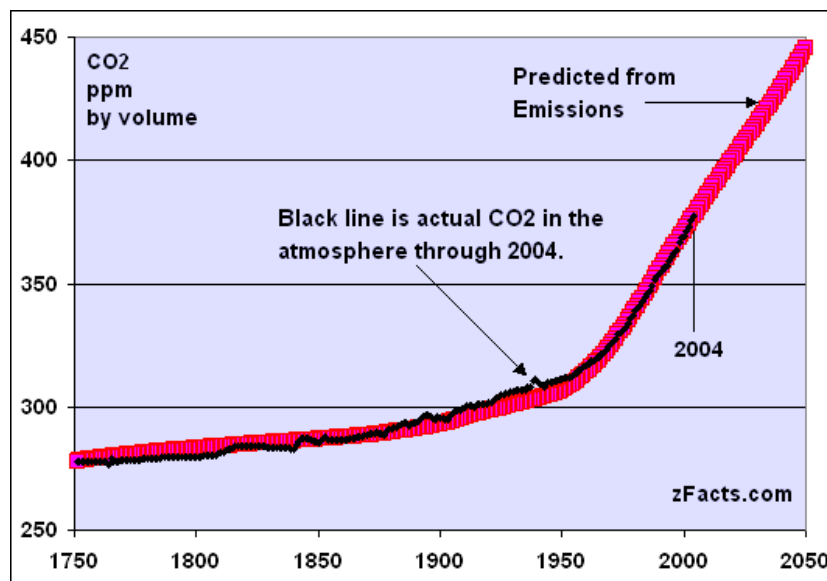


FIGURE 3: CO2 PPM FORECAST

<sup>4</sup> IPCC Fourth Assessment Report “Climate Change 2007: The Synthesis Report”

<sup>5</sup> Tufts University report “Florida Climate Change: The Costs of Inaction” November, 2007.

## Local Climate Change in Florida

Global warming's real-world effect on life in Florida and the Florida Keys cannot be underestimated or ignored. With over 1,300 miles of coastline in the state, our coastal communities are at ground zero to experience the impacts of global warming. Florida's sea level is already rising 7-9 inches per century along much of Florida's coast<sup>6</sup>. The predicted sea level rise for this century due to climate change is a staggering 8-30 inches. A 12-inch increase in sea level will flood or erode between 100 and 1000 feet of coastal real estate. With most of Key West within one foot of extreme high tides<sup>7</sup>, we have no time to wait.



Figure 4: Key West with 1.0 meter of sea level rise  
Source: Architecture 2030

Some of the potential effects of global warming that Florida may experience in the future were explained in a report entitled "Feeling the Heat in Florida: Global Warming on the Local Level,"<sup>8</sup> prepared by the Florida Climate Alliance and the National Resources Defense Council. Among the threats global warming poses for Florida's people and resources:

- As glaciers melt and warming waters expand, sea levels will rise anywhere from eight inches to two-and-a-half feet over the next century. In Florida, seawater will advance inland, flooding shoreline homes and hotels, limiting future development, and eroding the state's beloved beaches.

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<sup>6</sup> "Climate Change and Florida" EPA 230-F-97-008i, 1997  
[http://yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/SHSU5BUKSV/\\$File/fl\\_impct.pdf](http://yosemite.epa.gov/OAR/globalwarming.nsf/UniqueKeyLookup/SHSU5BUKSV/$File/fl_impct.pdf)

<sup>7</sup> Key West stormwater engineer Annalise Mannix

<sup>8</sup> Florida Climate Alliance & the Natural Resources Defense Council, Feeling the Heat in Florida: Global Warming on the Local Level, New York, New York, October 2001. <http://www.nrdc.org/globalwarming/florida/florida.pdf>

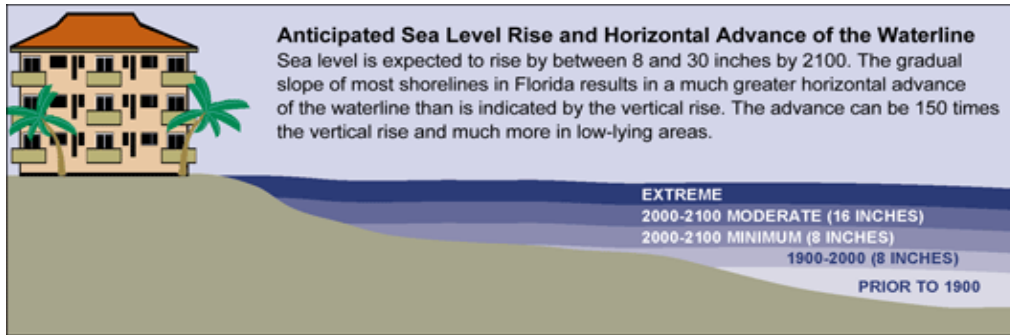


FIGURE 5. SOURCE: NATIONAL RESOURCE DEFENSE COUNCIL

- Tourism will likely suffer. Coral reefs ecosystems, a cornerstone of the Keys' appeal as a tourist destination, are extremely sensitive to climate change. The increased sea temperatures caused by a warming world contribute to severe coral bleaching events and render corals more susceptible to diseases. Also, the burning of fossil fuels releases carbon dioxide which acidifies the chemical balance of the oceans, weakening coral skeletons.
- As salt water encroaches inland, freshwater supplies feeding Florida's cities, agriculture, and tourist centers will be at risk of saltwater contamination.
- Saltwater encroachment will also likely inundate coastal wetlands, gravely threatening the lower Everglades and its wildlife.
- Sea level rise, climbing temperatures, and alterations in rainfall will combine to damage beaches, the Everglades, coral reefs and other unique ecosystems that make Florida such an appealing tourist destination.
- Global warming will pose specific health threats to Florida's citizens, likely increasing the incidence of heat-related illness, exacerbating poor air quality, and perhaps even making it easier for infectious diseases to spread through the increase of insect vectors. Florida's seniors will be particularly susceptible to these effects.
- The impact of global warming on agriculture may not be felt at first; indeed, it is possible that climate and water conditions will help some commercial crops in the short run. But it's likely that climate changes will lead to lower yields of such important cash crops as citrus, sugarcane and tomatoes.
- Forest wildfires are very likely to be more common, and do more damage -- the result of higher temperatures and more intense droughts -- although the magnitude of this effect will depend on overall changes in rainfall. Also, global warming may increase the threat to forests from invasive species and pests.

### **Financial Impacts for Florida:**

According to a November, 2007 Tufts University report titled “Florida and Climate Change: The Cost of Inaction,” climate change could cost Florida an additional \$27 billion by 2025 and \$345 billion by 2100 if carbon dioxide and other greenhouse gas emissions continue to increase at current rates. The report estimates losses to tourism, increased costs for energy, the cost of hurricanes and the loss of property as the climate warms, sea levels rise and storms worsen.

The study examined two potential climate change scenarios and the effects of those scenarios on Florida’s economy:

- 1) The *rapid stabilization* scenario portrays the most optimistic view of the lowest emissions under discussion today – that is, the best future that we can expect if the world enters into a robust program of climate mitigation.
- 2) The *business-as-usual* scenario represents the worst of what the IPCC calls its “likely” projections, with atmospheric concentrations of carbon dioxide exceeding the critical threshold of 450 ppm by 2030 and reaching 850 ppm by 2100.

The study concludes that while taking the necessary action to reduce carbon emissions to the necessary level of 80% reduction by 2050 undoubtedly requires some significant financial investment, the cost of doing *nothing* to mitigate and adapt to the effects of climate change will have a far greater negative impact on Florida’s future, economic and otherwise.

## ***C. Action Being Taken on Climate Change***

### **International Action**

The international response to climate change was launched in 1992, at the Earth Summit in Rio de Janeiro, with the signing of the United Nations Framework Convention on Climate Change (UNFCCC). The Convention established a long-term objective of stabilizing greenhouse gas concentrations in the atmosphere "at a level that would prevent dangerous anthropogenic interference with the climate system." It also set a voluntary goal of reducing emissions from developed countries to 1990 levels by 2000 - a goal that most countries did not meet.

As evidence of climate change has mounted, groups at the international, federal, state and local level have responded with ways to confront the impending threat. Recognizing the problem of potential global climate change, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) established the Intergovernmental Panel on Climate Change (IPCC) in 1988 to assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk associated with human-induced climate change, its potential impacts and options for adaptation and mitigation, releasing its most recent assessment in 2007.<sup>9</sup>

In 1997, 10,000 international delegates, observers and journalists gathered in Kyoto, Japan to participate in the drafting and adoption of the Kyoto Protocol, which sets binding targets to reduce

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<sup>9</sup> Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: "Climate Change 2007: The Synthesis Report."

emissions 5.2 percent below 1990 levels by 2012<sup>10</sup>. As of February, 2006, 162 countries have ratified the Protocol, with the United States and Australia most notably absent from the list.

Most recently, representatives from over 180 nations met in Bali, Indonesia, in December, 2007, Indonesia to negotiate new climate change agreements beyond the Kyoto Protocol. The conference culminated in the adoption of the Bali roadmap, which charts the course for a new negotiating process to be concluded by 2009 that will ultimately lead to a post-2012 international agreement on climate change. Over the next two years, industrialized countries need to agree to deep emission cuts, and to leverage new funding and support for technology transfer, finance and adaptation.

### **State and Federal Action**

Though adequate attention and action related to combating climate change has been lacking at the federal level, Florida has taken significant steps at the state level. With Governor Charlie Crist at the helm, Florida has been leading the charge on combating climate change through legislation:

On July 13, 2007, Governor Crist set a new direction for Florida's energy future by signing a groundbreaking set of Executive Orders during the Serve to Preserve Florida Summit on Global Climate Change. The orders will guide Florida to reduce greenhouse gases, increase energy efficiency and pursue more renewable and alternative energy sources, such as solar and wind technologies, ethanol and hydrogen. Governor Crist signed Executive Order 07-126, titled "Leadership by Example: Immediate Actions to Reduce Greenhouse Gas Emissions from Florida State Government"; Executive Order 07-127, "Immediate Actions to Reduce Greenhouse Gas Emissions within Florida"; and Executive Order 07-128, "Florida Governor's Action Team on Energy and Climate Change."

At the close of the Summit, Governor Crist appointed an Action Team on Energy and Climate Change. The Action Team has already completed the Phase One report and will continue to develop a strategy to protect our state from the effects of climate change.

### **Local Action**

A great deal of work is being done at the local level on climate change as well. The first greenhouse gas reduction target adopted by any level of government was put forward by Toronto, Canada in 1989. That city's actions helped inspire the first formal municipal program for climate protection, the Urban CO<sub>2</sub> Reduction Project, which was launched in 1991 by the International Council for Local Environmental Initiatives (ICLEI). This program ultimately developed into the international Cities for Climate Protection (CCP) Campaign, which enlists local governments in developing targets, timelines and implementation strategies for reducing their emissions. The CCP Campaign now represents more than 770 local governments on six continents. In the United States, 350 cities, towns and counties participate in the CCP Campaign, representing 66 million people, or 22 percent of the American population.

ICLEI also works in conjunction with the U.S. Conference of Mayors to track progress and implementation of the U.S. Mayors Climate Protection Agreement, launched in 2005, which more than 700 mayors have signed to date pledging to meet or beat the Kyoto Protocol target of a 7%

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<sup>10</sup> 5.2% is the Kyoto reduction target for the majority of developed countries; the US target, signed but not ratified, is 7%

reduction in emissions from 1990 levels by 2012 in their own communities. As seen by the southernmost dot on the map in Figure 6.1, Key West is a proud signatory of the agreement.

In Florida, there are some fine examples of local governments' action on climate protection:

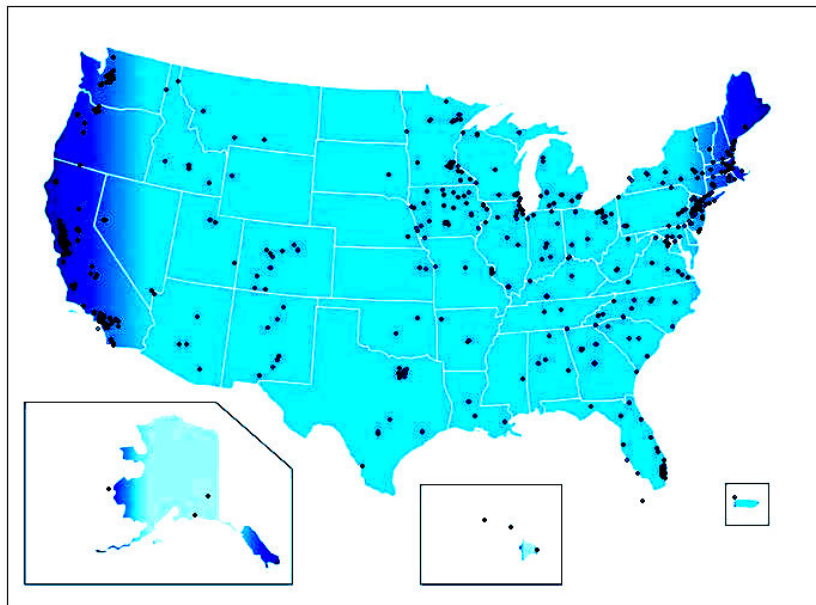
**Miami, FL: TREE CANOPY REMEDIATION AND REPLENISHMENT**

In 2002 Miami launched a comprehensive and aggressive environmental program to reverse decades of neglect; the aim is to improve climate protection and the City's livability by implementing sustainable urban design principles. Tree canopy remediation and replenishment are key components of this effort. The City is working to increase its tree canopy to 30 percent from its current seven percent and conducting a comprehensive analysis of the tree canopy in partnership with American Forests. Working with community groups, the private sector, and various government agencies, Miami is well on its way to meeting its goals.

**North Miami, FL: GREEN HOUSING REHABILITATION GUIDELINES**

The first "green" procurement ordinance in South Florida was created in North Miami. It offers preference points to vendors supplying green products or services and contains an administrative regulation which requires City staff to purchase only green products – cleaning products and recycled paper, for example – and to send correspondence electronically. The City maintains a Green North Miami Web site and publishes a Green North Miami Guide, both of which provide residents and business owners with tips on the steps they can take to reduce greenhouse gas emissions.

FIGURE 6: MAP OF MUNICIPAL SIGNATORIES OF US MAYOR'S CLIMATE PROTECTION AGREEMENT



## ***D. ICLEI and the Cities for Climate Protection Program***

ICLEI's mission is to improve the global environment through local action. The Cities for Climate Protection® (CCP) Campaign is ICLEI's flagship campaign designed to educate and empower local governments worldwide to take action on climate change. ICLEI provides resources, tools, and technical assistance to help local governments measure and reduce greenhouse gas emissions in their communities and their internal municipal operations.

**ICLEI—Local Governments for Sustainability** has been a leader on both the international and local level for more than ten years, representing over 770 local governments around the world. ICLEI was launched in the United States in 1995 and has grown to more than 350 cities and counties providing national leadership on climate protection and sustainable development.

### **Cities for Climate Protection (CCP) Campaign**

ICLEI was formed to assist local governments in developing sustainable and practical solutions to global environmental problems. The Cities for Climate Protection (CCP) Campaign focuses on global warming and climate change. CCP is a performance-oriented campaign that offers a framework for local governments to reduce greenhouse gas emissions and improve livability within their municipalities. The CCP Campaign achieves these results by linking climate change mitigation with actions that improve local air quality, reduce local governments' operating costs, and address other existing municipal concerns.

The Cities for Climate Protection Campaign involves a five-milestone process to achieve GHG emissions reductions. The five milestones are as follows:

**Milestone One:** Conduct a baseline emissions inventory and forecast.

**Milestone Two:** Set an emissions reduction target.

**Milestone Three:** Develop a Local Action Plan for reducing emissions.

**Milestone Four:** Implement policies and measures.

**Milestone Five:** Monitor emissions reductions and verify results.

On August 7, 2007, the city of Key West adopted a resolution to take action for climate protection and officially joined ICLEI's Cities for Climate Protection Campaign. The city has completed Milestone One and will proceed by formally setting an emissions reduction target and developing a Local Action Plan in the coming months.

While it is not possible for Key West to unilaterally end global warming, it is also not possible for the problem to be solved without effective and meaningful leadership at every level of government, no matter how small. Citizens and governments in developed nations and in the United States in particular, have a responsibility to consider both their own role in causing this global problem and their relative capacity to solve it. Due to our country's high per capita contribution to global-warming and high ability to respond or make changes (relative wealth) we have a responsibility to take a leadership role in the solution to this problem.

But perhaps more compelling than questions of consequence, need, and responsibility, is the increasingly well-documented fact that actions to reduce global-warming pollution have net positive effects on budgets and the economy. These benefits include:

- Job creation
- Reduced energy costs
- Improved health
- Decreased vulnerability to fossil fuel market fluctuations
- Decreased vulnerability to future carbon pollution regulations
- Reduced traffic congestion
- Improved livability and quality of life
- Energy-efficiency and renewable-energy investments keep our energy dollars circulating in the local economy.

Achieving a significant and meaningful reduction target will require some investment on the part of city government. The mounting consequences of global warming are appearing first as local problems, so it is appropriate that the global solution will also begin to appear at the local level. The longer we wait, the more pollution accumulates in the atmosphere. On the other hand, actions taken now will begin to pay for themselves. Payback and environmental benefits can be quickly realized and eventually the clean energy industry will become an economic factor in our region.

**Overall Goal:**

To reduce the emissions of gases and air pollutants that contribute to global climate change and local air quality degradation.

**Key West Specific Objectives:**

1. Improve and protect Key West's quality of life in the future.
2. Raise awareness of global climate change and the sources of greenhouse gases.
3. Implement public programs to increase energy and transportation efficiency as well as solid waste reduction in order to reduce Key West's contribution to the global problem of climate change.
4. Develop practices to reduce the emission of greenhouse gases and increase operational cost efficiency in municipal operations.

## *II. Greenhouse Gas Emissions Inventory*

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In order to forecast and measure progress towards future reductions, the city committed to establishing an inventory of energy use and emissions for a baseline year. From October through December, 2007, this inventory was conducted and the findings are summarized later in this report. The inventory used the city's fiscal year 2005 (Oct, 2004 through Sept, 2005) as its baseline year. An interim year of fiscal year 2007 (Oct, 2006 through Sept, 2007) was also measured. The total energy consumption and greenhouse gas emissions of all municipal government facilities and operations in FY 2005 were measured and recorded. Energy cost, as available, was also inventoried in order to better measure the costs and benefits of future proposed changes in energy use.

The next step is to create a Local Climate Action Plan. This document is the first step in the development of the plan, which will set a target for emissions reductions. The plan will outline the policies and measures that the city will take to achieve the emissions reduction target. This plan will be fully developed to include a timeline, a description of financing mechanisms, and an assignment of responsibility to City departments and staff. The plan will incorporate public awareness and educational efforts. The development of the Local Climate Action Plan will include public input and involvement in order to build consensus among stakeholders required to implement measures.

### *A. Methodology*

#### *1. CACP Software*

To facilitate local government efforts to identify and reduce greenhouse gas emissions, ICLEI developed the **Clean Air and Climate Protection (CACP)** Software package with Torrie Smith Associates. This software estimates emissions derived from energy consumption and waste generation within a community. The CACP software is also useful as a planning tool to calculate the energy, money, and greenhouse gas savings from both existing and proposed greenhouse gas reducing policies and measures. The CACP software determines emissions using specific factors (or coefficients) according to the type of fuel used. Emissions are aggregated and reported in terms of equivalent carbon dioxide units, or CO<sub>2</sub>e. Converting all emissions to equivalent carbon dioxide units allows for the consideration of different greenhouse gases in comparable terms. For example, methane is twenty-one times more powerful than carbon dioxide in its capacity to trap heat, so the model converts one ton of methane emissions to 21 tons of CO<sub>2</sub>e. Additionally, the program measures the production of other criteria air pollutants and this data has been included as appendices to this report (APPENDIX E-6 and E-7).

The emissions coefficients and methodology employed by the software are consistent with national and international inventory standards established by the Intergovernmental Panel on Climate Change (1996 Revised IPCC Guidelines for the Preparation of National Inventories) and the U.S. Voluntary Greenhouse Gas Reporting Guidelines (EIA form 1605).

The CACP software has been and continues to be used by over 350 U.S. cities and counties to reduce their greenhouse gas emissions. However, it is worth noting that, although the software provides a sophisticated and useful tool, calculating emissions from energy use with precision is difficult. The model depends upon numerous assumptions, and it is limited by the quantity and quality of available

data. With this in mind, it is useful to think of any specific number generated by the model as an approximation, rather than an exact value.

## ***2. Inventory Sources and Creation Process***

The creation of an emissions inventory required the collection of information from a variety of sectors and sources. These data were entered into the software to create a **community emissions inventory** and a **municipal emissions inventory**. The community inventory represents all energy use within Key West and its contribution to greenhouse gas emissions. The municipal inventory is a subset of the community inventory, and includes energy use and emissions derived from internal government operations.

There are two main reasons for completing separate emissions inventories for community and municipal operations. First, the government is committed to action on climate change, and has a higher degree of control to achieve reductions in its own municipal emissions than those created by the community at large. Second, by proactively reducing emissions generated by our own activities, the Key West government takes a visible leadership role in the effort to address climate change. This is important for inspiring local action in Key West as well as for inspiring other communities.

The data collected do not include all emissions that could be identified or quantified. Rather, the focus is on those areas over which the city government has the most influence. For example, data regarding Key West Airport was not collected even though, on a per capita basis, air travel is often one of the most significant sources of greenhouse gas pollution. City government holds relatively little influence over individual residents' air travel choices, and much of that travel is combined with other, larger regional airports. The accuracy of any attempt to quantify such emissions would be highly questionable, and its usefulness as a policy tool would be relatively minimal. The following sources of emissions are not included in this data set:

- Air travel
- Non-road fuel use (riding lawn mowers, off-road vehicles, construction vehicles, etc.)
- Water travel <sup>11</sup>
- Upstream energy from consumer products and food
- Other greenhouse gases including N<sub>2</sub>O, CFCs and SH<sub>6</sub>

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<sup>11</sup> Water travel and marine fuel consumption are significant in Key West, due to its island geography. Recreational and commercial boating, as well as the large Navy and Coast Guard presence, contribute to the community's GHG emissions from marine fuel. An attempt was made to collect data on marine fuel from private marinas, Navy and Coast Guard; however, complete data was not provided in a timely manner to allow inclusion in this inventory. It may be useful to amend the report once this data is available and to include potential reduction measures related to water travel in the Local Action Plan.

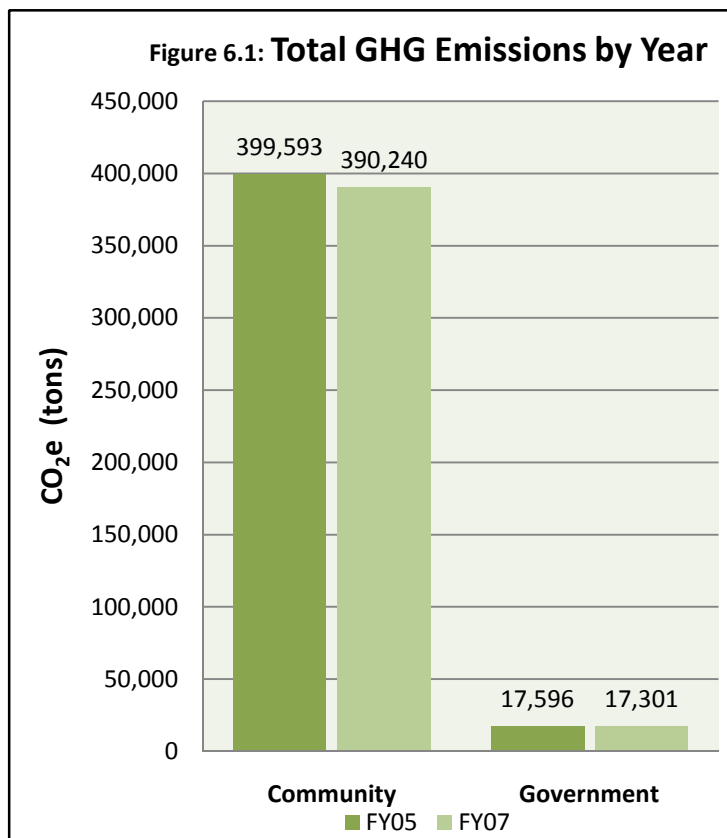
## B. Emissions Inventory Results Summary

Greenhouse gas emissions were inventoried for the baseline year of fiscal 2004-2005 (October '04 through September '05; hereinafter referred to as FY05) and an interim year of fiscal year 2006-2007 (October '06 through September '07; hereinafter referred to as FY07.) The inventory measures emissions for the community as a whole, with a more detailed look at municipal government operations as a subset of the community emissions. Each of these categories is further broken down by **sources** and **sectors**:

**Sources** are the fuel or energy that is the basis of the emissions. In this inventory the main sources considered are **electricity, propane, diesel, gasoline, landfill gas** and **CO<sub>2</sub>**.

**Sectors** are the categories of the community or government operations which contribute the emissions. In the community analysis the sectors considered were **residential, commercial, transportation** and **waste**. In city operations the sectors considered are **buildings, vehicle fleet, employee commute, streetlights, water/sewer** and **waste**.

Figure 6.1 depicts the total emissions for the community as a whole and also the municipal government emissions for the baseline and interim years measured.



In FY05, total emissions for the city of Key West were calculated to be 399,593 tons of carbon dioxide equivalents (CO<sub>2</sub>e) and in FY07, the total emissions measured 390,240 tons CO<sub>2</sub>e, representing a 2.3% decrease. Unlike many places in the country which have experienced rapid growth in population and emissions over the past several years, several factors contribute to the fact that Key West's emissions have remained relatively static. Lack of significant new construction, combined with an increase of seasonal second home owners rather than full time residents, and heavy hurricane activity during the summers of 2004 and 2005, have contributed to a slight decrease in population and energy use since the 2000 census <sup>12</sup>.

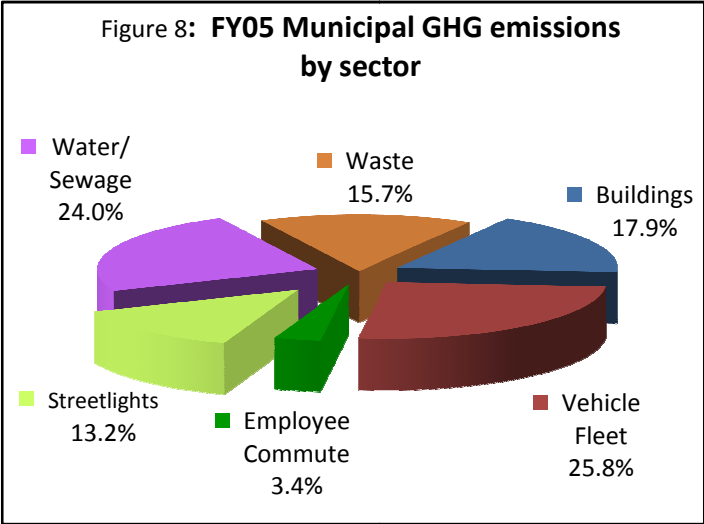
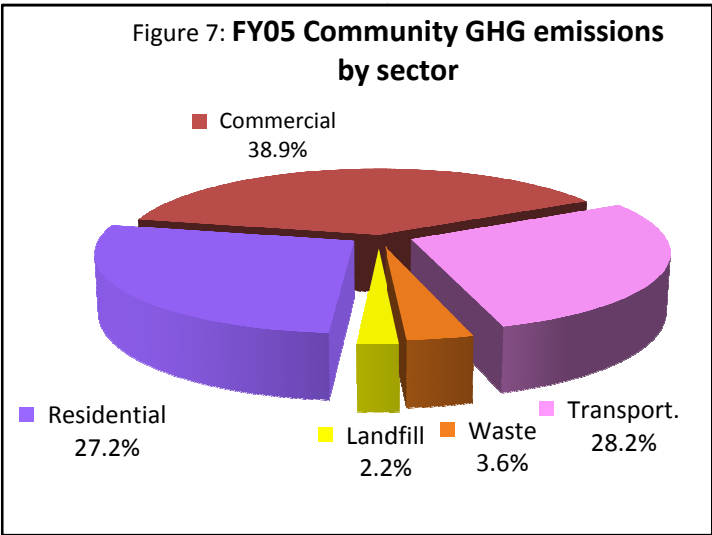
<sup>12</sup> According to the U.S. Bureau of the Census, as prepared by the South Florida Regional Planning Council, Key West population in 2000 was 25,478 and the estimated population in 2006 was 25,319.

The city government’s operations in FY05 accounted for 17,596 tons of GHG emissions, or 4.4% of total community emissions. As a comparison, most municipal inventories fall within 2-5% of the total community inventory. From FY05 to FY07, government emissions showed a slight decrease of 1.7%.

According to this inventory, per capita emissions for Key West in FY05 were 16.7 tons CO<sub>2</sub>e, as compared to the national average of approximately 26.7<sup>13</sup> tons per capita.

The largest contributor of emissions in the community inventory in FY05 came from the commercial sector, at 38.9 % of total emissions. Adding emissions from the residential sector (27.2%) gives a total for the “built environment” of 66.1% of total community emissions.

In the government analysis, the vehicle fleet sector (25.8%) and the sewage/water sector (24%) were the two largest contributors of emissions.



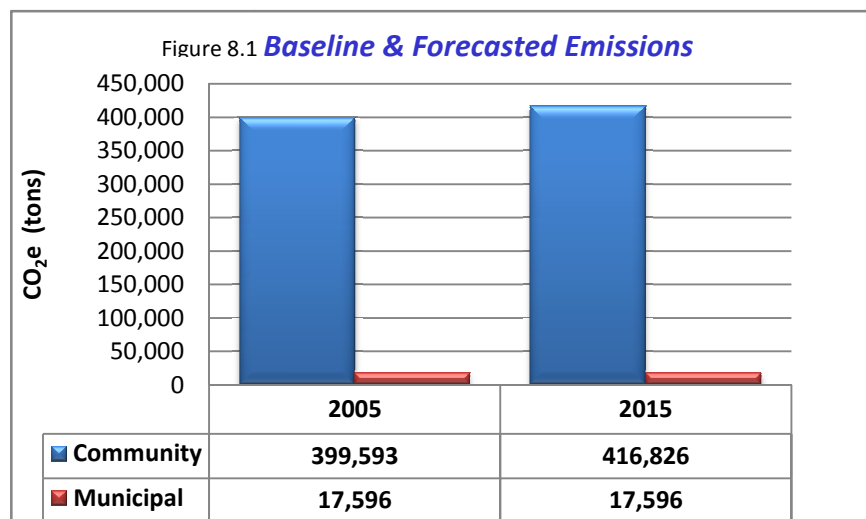
*The inventory is intended as a tool to focus policy makers’ and community attention on the areas with the largest room for improvement.*

*Clearly defining the scope and nature of the problem allows us to direct our attention where efforts will have the most effect.*

<sup>13</sup> US DOE Energy Information Administration: <ftp://ftp.eia.doe.gov/pub/oiaf/1605/cdrom/pdf/ggrpt/057306.pdf>. Metric tons were converted into US tons of CO<sub>2</sub>e.

When the question is examined of where emissions reductions are possible, there will be a different set of options for city-owned facilities and operations than for private sector emissions. For example, the city might implement a procurement policy requiring that certain vehicles in the city fleet be replaced by hybrid vehicles, whereas in the private sector an education program about hybrids or an incentive program would be appropriate. These two segments work in concert as the city's leadership helps establish its credibility as a messenger, and public education provides increased public support for continued city action.

A forecast of predicted Community and Government emissions by the year 2015 was included in the inventory. The forecast measures expected emissions under a "business as usual" scenario; meaning if the city takes no action toward reduction of GHG emissions. By 2015, Key West community emissions are expected to increase to 416,826 tons CO<sub>2</sub>e, a 4.3% increase over baseline FY05 levels. Tools and methodology used to arrive at forecasted numbers for the Community Inventory included projections for the South Atlantic region in residential and commercial per capita electricity use, as provided by the U.S. Department of Energy's EIA (*Energy Information Administration*), as well as waste projections provided by the city's Public Works Department. Population was assumed to hold constant, due to the limitations of land and growth as explained earlier.



Forecasted emissions for the Municipal Inventory were assumed not to change significantly by the target year of 2015 under a business-as-usual scenario. According to the Planning Department, there are no new government buildings or facilities officially planned. There has been discussion about a new City Hall being built; however, the details of those plans are not available and thus, this potential change in operations and the effect on overall government GHG emissions cannot adequately be analyzed or anticipated at this time. The Fleet Department reports no expected changes to vehicle type composition, mileage or fuel efficiency. The municipal solid waste forecast from Public Works does not include any change in the amount of "non-billable tons" of waste, that which is allocated to city government operations.

Additionally, any potential increase in electricity use (which accounts for 55.3% of total government emissions) would likely be offset by the increased efficiency in the electric grid by the year 2015.

***The second Milestone in the Cities for Climate Protection program is to establish a reduction target.***

A quantifiable goal will provide an objective for which to strive and against which to measure progress. Based on the findings of the inventory, an examination of existing and possible measures and a review of other community's targets, a Climate Protection Task Force will recommend reduction targets for municipal operations and for the entire community. The target should be both ambitious and achievable, and must take into account expected increases of emissions under the business-as-usual scenario when setting a goal for overall emissions reductions. In other words, the expected 4.3% increase in community emissions by 2015 must be overcome in addition to targeted reductions below FY05 levels in order to achieve the overall reduction goal.

### **1. Municipal Emissions Profile**

In order to complete Milestone One, a Program Assistant (Jody Smith Williams, author of this report) was hired to conduct the GHG emissions inventory. A city staff liaison (Annalise Mannix, Environmental Programs Manager) was assigned to facilitate communications among staff, to provide historical information on city operations and to oversee the work of the Program Assistant. The first step was to contact all department heads and to request data for the six different sectors:

- Buildings
- Vehicle Fleet
- Employee Commute
- Street Lights (including Traffic Signals and Parks)
- Water and Sewer
- Waste

Key West conducted a detailed study of two fiscal years: FY05 (October 2004 through September 2005) as the baseline year, and FY07 (Oct. 2006 through Sept. 2007) as an interim year by which to measure any changes since the baseline year. Data was developed from department staff in the form of historical records and individual expertise.

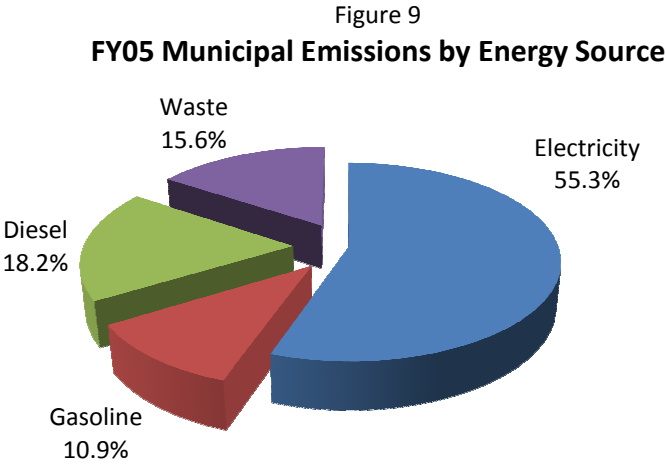
All electricity information was supplied by the city Finance Department and by Keys Energy Services in the form of an Excel spreadsheet. Cost information was also supplied by Keys Energy Services and city staff.

The Municipal Government Emissions Profile shows that in FY05, government operations produced a total of 119,572 MMBtus (million British Thermal Units<sup>14</sup>) of energy consumption and 17,596 tons of CO<sub>2</sub>e emissions, which accounted for 4.1% of total community energy consumption and 4.4% of total community greenhouse gas emissions as measured in CO<sub>2</sub> equivalents (CO<sub>2</sub>e.)

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<sup>14</sup> British Thermal Unit - a standard unit of measurement for heat energy created by burning any material

Figure 9 below displays the breakdown of government emissions by energy source. Electricity is clearly the largest source of CO<sub>2</sub>e emissions (55.3%), followed by diesel fuel (18.2%), waste (15.6%) and gasoline (10.9%).



**BREAKDOWN BY SECTOR**

The municipal profile is divided into the following sectors: Buildings, Vehicle Fleet, Streetlights, Water/Sewer, Employee Commute, and Waste. The breakdown of greenhouse gas emissions associated with these sectors is described in Figure 9.1 and Table 1 below:

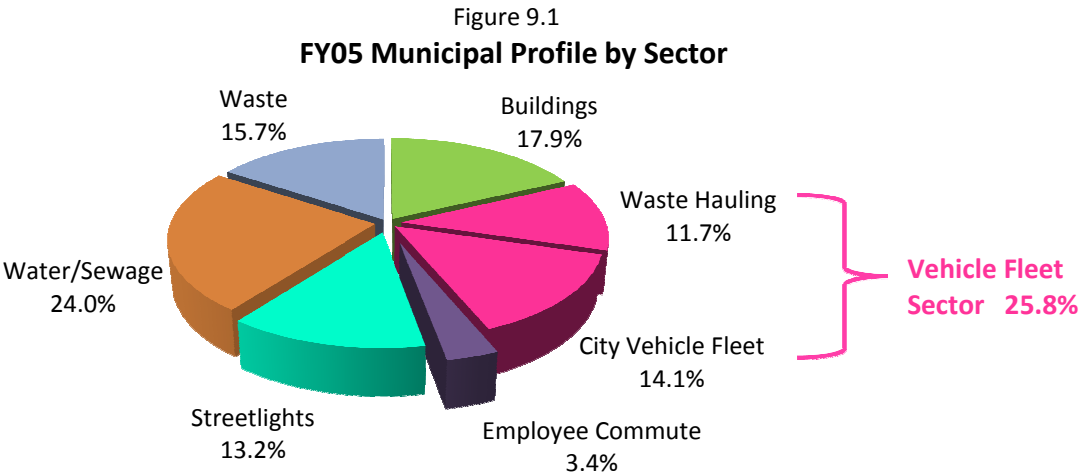


Table 1

<i>FY05 Government Emissions by Sector</i>	<i>Equiv CO2 (tons)</i>	<i>Equiv CO2 (%)</i>	<i>Energy (MMBtu)</i>	<i>Cost (\$)</i>
<b>Buildings</b>	3,158	17.9	17,493	591,076
<b>Vehicle Fleet Total</b>	4,532	25.8	58,732	605,387
<b>City vehicles</b>	2,482	14.1	28,864	605,387
<b>Waste hauling</b>	2,050	11.7	29,868	-
<b>Employee Commute</b>	602	3.4	7,070	-
<b>Streetlights</b>	2,331	13.2	12,914	461,925
<b>Water/Sewage</b>	4,217	24.4	23,363	752,219
<b>Waste</b>	2,756	15.7		717,062
<b>Total</b>	17,596	100	119,572	3,157,659

### **Buildings & Facilities**

The Buildings sector includes buildings and facilities which are owned or leased by the city. In FY05 this sector represented 17.9 % of total CO<sub>2</sub>e emissions for government operations. Data was gathered through electric bills from the city Finance Dept. and also from Keys Energy Services. Many of these bills had duplicate service location names and were not easily identified as belonging to a particular department or building. City staff was consulted to identify as specifically as possible what each account was associated with; however, there is no facilities manager for the city who maintains records and oversees bills associated with each department. All electric bills go directly to the Finance Department and are not seen by individual department heads. Therefore, department heads are not familiar with electric meters, accounts and energy consumption which fall under their jurisdiction.

Keys Energy Services allocates many electric accounts to city operations which are not paid by the city. Most of these pertain to non-profit offices such as Wesley House, Florida Keys Outreach Coalition, etc. which are city owned buildings that are leased. According to Keys Energy Services, the city most likely set up the accounts to avoid connection and service charges, but the bills are passed through to the tenants and therefore, are not maintained within the Finance Department's records. Most of these accounts have been classified in the "Other" category. Also included as 'Other' are accounts related to city operations that could not be identified with a particular department or use. All 'Other' accounts are included as part of the inventory since the city maintains some jurisdiction and influence over the operations of these facilities and has the ability to affect changes that may reduce associated emissions.

Overall energy use and emissions for buildings decreased by 3.6% between FY05 and FY07 while at the same time, the electricity cost for these buildings increased by 13.6%.

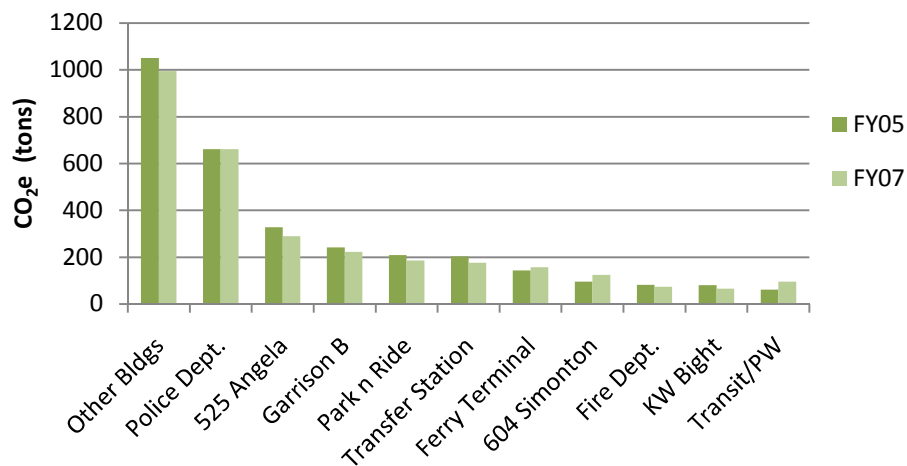
There have been many changes and moves among departments and buildings over the past several years due to displacements from Hurricane Wilma and other factors. For this reason it was not

feasible to separate energy use by each department. Table 2 and Figure 10 below demonstrate the breakdown for those buildings, facilities or departments which were clearly identified.

**Table 2: City Buildings & Facilities**

Building/Facility	Equiv CO2 (tons)		Energy (MMBtu)		Equiv CO2 (%)		Cost (\$)	
	FY05	FY07	FY05	FY07	FY05	FY07	FY05	FY07
Other Buildings/ Facilities	1,051	995	5,821	5,712	33.28%	33.46%	\$204,526	\$228,091
Police Dept.	662	662	3,669	3,799	20.96%	22.27%	\$116,650	\$136,564
525 Angela – City Hall	328	290	1,816	1,663	10.39%	9.75%	\$56,948	\$61,255
Garrison Bight	242	223	1,342	1,282	7.66%	4.98%	\$44,986	\$48,721
Grinnell Park n' Ride	209	186	1,157	1,067	6.62%	6.26%	\$34,479	\$36,735
Transfer Station	204	176	1,128	1,013	6.46%	5.91%	\$38,239	\$40,006
Ferry Terminal	143	157	790	900	4.53%	5.28%	\$25,560	\$33,735
604 Simonton St. – City Hall Annex	96	124	534	712	3.04%	4.17%	\$17,686	\$25,943
Fire Dept.	82	74	452	424	2.60%	2.49%	\$14,357	\$15,198
KW Bight	80	66	445	379	2.53%	2.22%	\$22,431	\$23,934
Transit/Public Works	61	96	339	550	1.93%	3.23%	\$15,214	\$21,295
<b>Total Buildings</b>	<b>3,158</b>	<b>3,048</b>	<b>17,493</b>	<b>17,501</b>	<b>100%</b>	<b>100%</b>	<b>\$591,076</b>	<b>\$671,477</b>

**Figure 10: City Buildings & Facilities**



*As a result of the inventory process, it was discovered that there is at least one leased building for which the city has been paying substantial electric bills for several years, even though the lease agreement states that the tenant is responsible for paying for electricity. This most likely has occurred due to the lack of a closed system of oversight for city buildings and associated utility accounts, and presents an opportunity to streamline operations in order to avoid similar scenarios in the future.*

## **Vehicle Fleet**

The city vehicle fleet currently consists of 290 vehicles, of which 15 are transit buses. Data was received from the Fleet Department with a breakdown of fuel use by vehicle type (e.g., mid-size, heavy truck, bus, etc.) for FY07 only. Hurricane Wilma in October, 2005 destroyed the department's TRAK computer system, and all records prior to that date were lost. The Finance department was able to provide total gasoline and diesel fuel usage for both FY05 and FY07; therefore, the percentage breakdown by vehicle type from FY07 was extrapolated and applied to FY05 in order to arrive at estimated gasoline and diesel use by vehicle type, with the exception of transit (bus) use. Actual figures for transit fuel were available from Finance for both FY05 and FY07.

Total vehicle fleet emissions amounted to 4,528 tons of CO<sub>2</sub>e during FY05. This represents the largest contributing sector to municipal emissions at 25.7%. City department vehicles contributed 14.1% of the total and the other 11.7% of CO<sub>2</sub>e emissions attributed to fleet operations came from hauling municipal solid waste (MSW) 200 miles each way out of the county. While MSW hauling is handled by a private contractor, the associated emissions are the result of the current waste system in place, a decision which is in the hands of the city to either maintain or change. For that reason it is included in the municipal inventory.

Table 3

<i>Vehicle Fleet FY05</i>	<i>Equiv CO2 (tons)</i>	<i>Energy (MMBtu)</i>	<i>Cost</i>
City Vehicle Fleet	2,482	28,864	\$605,387
Waste Management haul-out	2,046	24,817	-
Total	4,528	53,681	\$605,387

In October, 2005, the city expanded its transit operations to include service from Key West to Marathon, an increase of 45 miles each way. Due to this expansion, diesel fuel and associated emissions for transit increased by approximately 60%. During FY07, ridership on this new route totaled 82,466 one-way trips. Assuming that those riders would have otherwise driven in single passenger vehicles, and furthermore assuming that all riders would have completed the full 45-mile journey in their cars, the amount of CO<sub>2</sub>e displaced by the increase in transit service was 2,432 tons<sup>15</sup>. By contrast, the additional mileage for the expanded bus service produced an additional 508 tons of CO<sub>2</sub>e emissions, for a net *decrease* in total community emissions of 1,924 tons.

There are two ways to reduce carbon emissions in the vehicle fleet: 1) reduce energy consumption and 2) use alternative fuel sources. For certain departments which use heavy and light trucks, such as Public Works or Fire, poor gas mileage is inevitable. However, many departments using light trucks/SUVs and full size cars also experience poor gas mileage. Energy consumption reductions may be achieved through better fuel efficiency, proper sizing of vehicles for the task performed, and ensuring that vehicles are not consuming fuel while idle.

<sup>15</sup> Calculation to achieve displaced emissions from would-be drivers: 82,466 trips x 45 miles = 3,710,970 VMT. Using the CACP software coefficients for passenger vehicles, this equates to 2,432 tons of CO<sub>2</sub>e emissions which would have been produced without the transit system in place. Transit emissions of 508 tons CO<sub>2</sub>e were subtracted to arrive at the net displacement figure of 1,924 tons.

*In November, 2007, the city began using B20 biodiesel (80% petroleum diesel and 20% biofuel) for its entire fleet, including transit buses. This change is expected to reduce emissions by 338 tons CO<sub>2</sub>e per year by the target year of 2015, for an overall emissions reduction in the municipal sector of 1.9%.*

## **Employee Commute**

In FY05, the city had 472 full time employees. Of those, 123 used city take-home vehicles for commuting to and from work. Emissions pertaining to those vehicles are already included under the Vehicle Fleet sector.

Surveys regarding employee vehicle miles traveled (VMT) to and from work, and vehicle type, were sent to all current city employees. 132 surveys were returned by employees who had been employed during FY05, representing a statistically significant 38% of all employees who did not drive take-home vehicles. An average VMT per employee was calculated (2,210 miles per year) and a breakdown by vehicle type was extrapolated to arrive at a total VMT by vehicle type for the 349 employees who did not drive city vehicles.

Total emissions contributed by employees' commuting was 602 tons of CO<sub>2</sub>e, or 3.4% of total government emissions. Some interesting findings from the survey include:

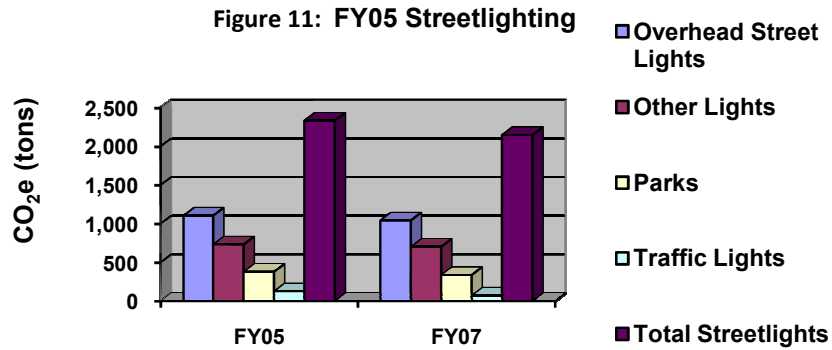
- 14.4% of those surveyed either walked or bicycled to work and therefore contributed no emissions.
- 34.8% of those surveyed who did not walk or bicycle commuted less than 2 miles round trip.
- Zero respondents stated that they took the bus to work.
- One respondent stated that he/she carpooled to work.

This information presents some possible opportunities for emissions reductions through encouragement and incentives for employees to walk, bike, carpool or take public transportation to work.

## **Streetlights**

Streetlighting accounted for 13.5% of the government emissions in FY05. The Streetlight sector includes four categories: overhead streetlights; other lights such as memorial lighting and old fashioned streetlights; traffic lights; and parks and recreational facilities.

Overhead streetlights accounted for 47.3% of total streetlighting. As the intensity of street lighting is generally a function of other factors (such as safety and physical location), the best opportunity for reducing emissions associated with street lighting is to replace older technology with more efficient bulbs, such as sodium vapor. The majority of the city overhead streetlights are already sodium vapor lights of 100 or 200 watt capacity, with less than 15% remaining of older mercury vapor lights. All 400 watt bulbs are being phased out in favor of 100 or 200 watt bulbs, and the city and Keys Energy Services have begun changing the globe style to a cut-off optic style of the same wattage, for the purposes of allowing "dark skies" and focusing the light where it is most needed.



**Table 4**

<i>Streetlighting</i>	<i>Equiv CO2 (tons)</i>		<i>Equiv CO2 (%)</i>		<i>(MMBtu)</i>		<i>Cost (\$)</i>	
	FY05	FY07	FY05	FY07	FY05	FY07	FY05	FY07
Overhead Street Lights	1,102	1,040	47.28%	48.5%	6,105	5,973	\$232,525	\$261,697
Other Lights	730	700	31.32%	32.6%	4,043	4,019	\$145,665	\$162,891
Parks	376	335	16.13%	15.62%	2,084	1,924	\$91,010	\$85,758
Traffic Lights	123	68	5.28%	3.17%	681	389	\$22,705	\$14,961
<b>Total Streetlights</b>	<b>2,331</b>	<b>2,144</b>	<b>100%</b>	<b>100%</b>	<b>12,913</b>	<b>12,306</b>	<b>\$491,905</b>	<b>\$525,307</b>

### Traffic Lights

The city began replacing incandescent traffic lights with much more efficient LED (light emitting diode) bulbs in December of 2001. Currently all traffic lights within the city limits have been replaced with LEDs. Between the baseline year of FY05 and FY07, this conversion reduced annual energy consumption from traffic lights by 42.8%, and CO<sub>2</sub>e was reduced by 55 tons (44.7%). This has resulted in a cost savings to the city of \$7,244 (despite increased electricity rates as mentioned above.) These bulbs also last up to 10 times longer than incandescent bulbs, which will significantly reduce staff maintenance time and costs.

*Sources: City Finance records provided account information for overhead streetlights and traffic lights, each of which has its own account. Parks and other lighting information was gleaned from Finance and Keys Energy Services account records; as stated under the Buildings sector, there were many accounts which were not clearly defined and there is no city staff person who is responsible for oversight of street lighting. Therefore, a best estimate was made as to the allocation of accounts included as other lighting and parks, based on conversations with various city staff.*

*Wayne Davila and Matthew Alfonso from Keys Energy Services provided details on the number and types of streetlights and traffic lights, and the conversion history for replacements.*

## **Water/Sewer**

The annual output of the Key West Waste Water Treatment Plant (WWTP) is currently 1,752 million gallons of water. Although there is no specific data available on output for FY05, the output is very consistent over the last several years, according to OMI supervisor Greg Smith. Energy was used by the water treatment plant at a rate of 11.3 MMBtu (or 3,311 kWh) per million gallons produced.

The Waste Water Treatment Plant was the second largest individual user of energy in FY05, contributing 24% of total emissions for the government operations. Given the nature of its work, the high energy consumption and associated emissions is understandable. It also presents an excellent opportunity, as even small increases in efficiency and water conservation can create substantial energy savings. In FY05, the WWTP accounted for 19,799 MMBtu of energy use and 3,574 tons of CO<sub>2</sub>e emissions, at an annual cost of \$602,618.

There are 24 pumping stations throughout the city, which consumed a total of 3,563 MMBtu of energy in FY05 and contributed 643 tons of CO<sub>2</sub>e at a cost of \$149,601.

**Table 5**

<i>Water/Sewage FY05</i>	<i>Equiv CO2 (tons)</i>	<i>Energy (MMBtu)</i>	<i>Cost</i>
Waste Water Treatment Plant	3,574	19,799	\$602,618
Pump Stations	643	3,563	\$149,601
Total	4,217	23,362	\$752,219

## **Waste**

In FY05, municipal solid waste (MSW) allocated to city government operations totaled 11,759 tons, approximately 19.4% of total community waste. While this number represents a seemingly high percentage, it represents all waste over which government has some control or influence – that which is not paid for by residential or commercial customers, named “non-billable tons” by the Public Works department. This includes all waste from government facilities, city cans in public places, street sweeping and debris removal, and trash collected by city trucks, including special events. Due to the high amount of tourism in Key West, we have much more “non-billable” waste from public cans and special events than one would expect in a less touristed city.

*Emissions contributed by the hauling of waste to the mainland are not included in the Waste sector, but rather as part of the Vehicle Fleet sector as explained in the previous section. If considered as part of the waste stream, total Waste sector emissions would equal 4,806 tons of eCO<sub>2</sub>, nearly double that which is currently allocated to waste.*

Since 2002, all city and community waste has been hauled to a waste-to-energy incinerator in Broward County. GHG emissions associated with government waste (incineration only) in FY05 totaled 2,756 tons of CO<sub>2</sub>e, or 15.9 % of total government emissions. The cost to the city for hauling and disposal in FY05 was \$717,062.

Recycling operations are not directly included as part of the municipal or community GHG emissions inventories. However, since total municipal solid waste includes any recyclable materials that are currently part of the waste

stream, it is important to note that any increase in recycling activities would lead to a net reduction in

overall waste and associated emissions. With current recycling rates below 7%, there is great opportunity to reduce emissions through diversion of recyclables from the waste stream. Likewise, 31% of the waste stream composition is attributed to organic waste. Any portion of this which would be converted to mulch and/or compost and remain in the city would reduce emissions not only from avoiding the incineration process, but also by decreasing emissions from hauling these materials 200 miles to the mainland.

## 2. Community Emissions Profile

In FY05, the Key West community produced 399,592 tons of carbon dioxide emissions. This amount equates to 16.7 tons of GHG emissions per capita for the city, compared to a national average of 26.7 tons<sup>16</sup>.

**Figure 12 - FY05 Community Inventory by Energy Source**

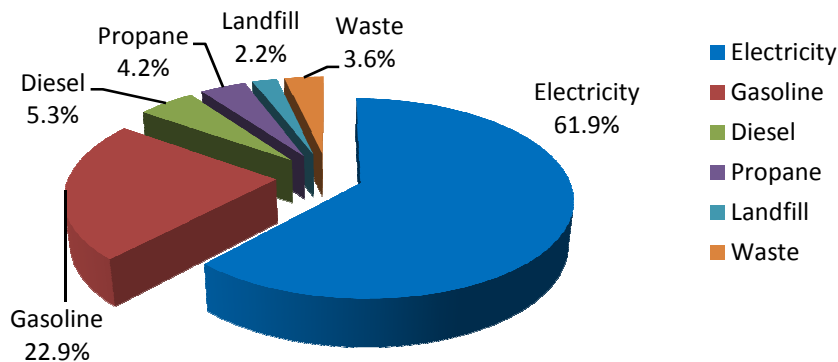
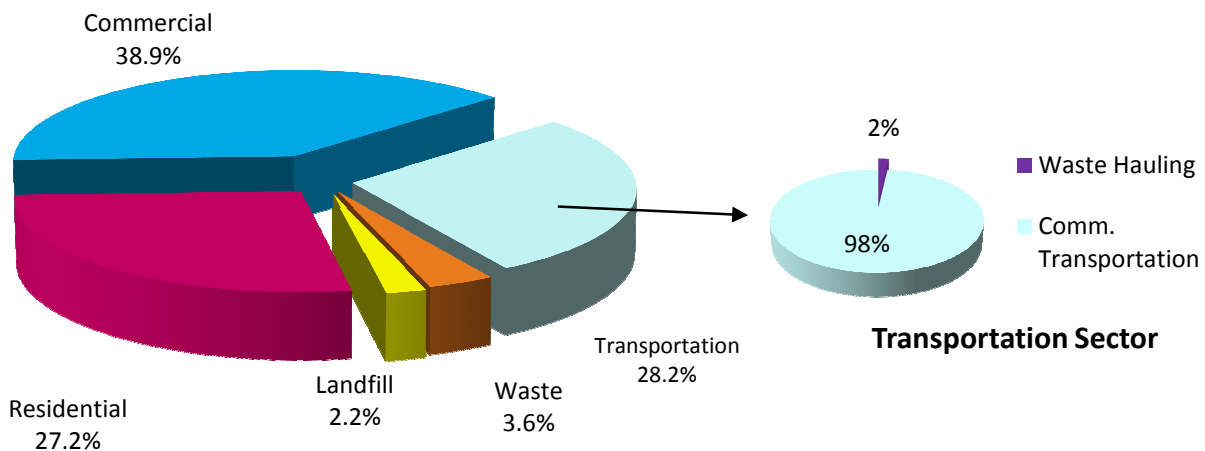


Figure 12 presents the Community Inventory by energy source for FY05. The figure shows that electricity is by far the foremost contributing source of GHG emissions (61.9%) with gasoline (22.9%) and diesel (5.3%) vehicle fuel second and third, respectively. The figure draws attention to the importance of addressing electricity consumption and exploration of alternative electricity sources, in order to reduce GHG emissions. The figure also highlights, to a lesser extent, the need to deal with emissions resulting from vehicle fuel.

**Figure 13- FY05 Community Inventory by Sector**

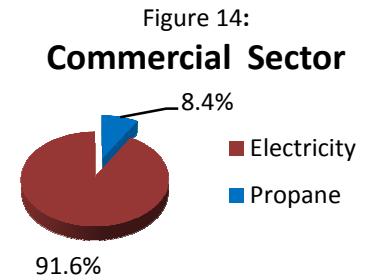


<sup>16</sup> US DOE Energy Information Administration: <ftp://ftp.eia.doe.gov/pub/oiaf/1605/cdrom/pdf/ggrpt/057306.pdf>. Metric tons were converted into US tons of CO<sub>2</sub>e.

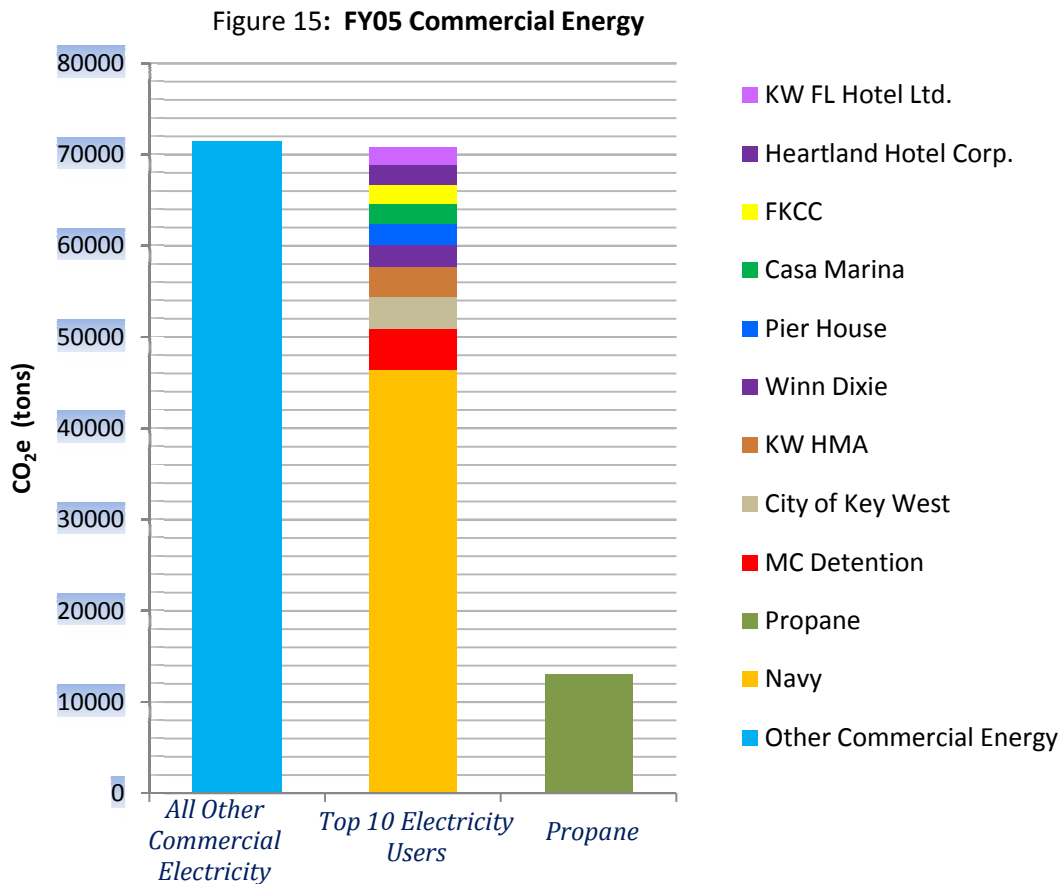
## BREAKDOWN BY SECTOR

### Commercial Sector

Energy use from the commercial sector comprised approximately 38.9% of all greenhouse gas emissions in the Key West community in FY05 and is the highest source of emissions. Activities in the commercial sector resulted in 155,322 tons of CO<sub>2</sub>e. Within the commercial sector itself, electricity accounts for 91.6% of emissions, while propane use makes up the other 8.4%. Data on commercial electricity use was provided by Keys Energy Services. Propane data was gathered through private sector propane companies which serve the Key West community.



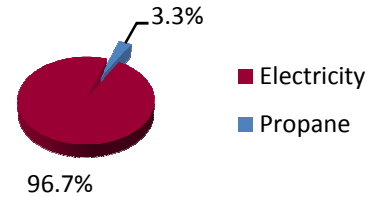
Keys Energy Services keeps data on the highest 10 commercial consumers of electricity in the city per year. Figure 15 breaks down the top 10 commercial users in FY05 (column 2) relative to all other users of electricity (column 1) and all commercial propane use (column 3.)



## **Residential Sector**

27.2% of all community CO<sub>2</sub>e emissions in FY05 were produced by the Residential sector, making this sector the third largest contributor of GHG emissions, just slightly behind the Transportation sector. 96.7% of residential energy use was attributed to electricity, and the remainder to household propane use for cooking, hot water heating, generators, etc. Total households in Key West according to the 2000 census were 13,306, amounting to a per household emission rate of 8.2 tons CO<sub>2</sub>e.

Figure 16:  
**Residential Sector**



## **Transportation**

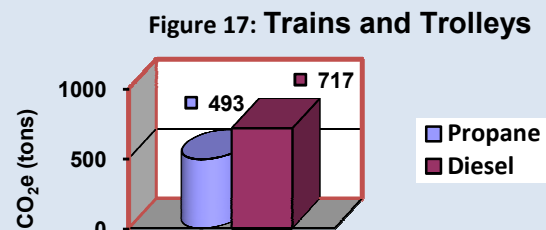
The Transportation sector was the second highest contributor of GHG emissions in FY05, comprising 28.2% of total community emissions. Total emissions from the transportation sector were estimated as 112,492 tons<sup>17</sup> of CO<sub>2</sub>e.

Emissions from vehicles were calculated using annual average daily traffic (AADT) data generated by the Florida Department of Transportation (FDOT.) The FDOT keeps a database for roads based on monitoring sites at certain points on these roads. The database includes 32.75 miles of roads in the city of Key West while total road miles equal 80.1. Although the calculation does not include all roads, it does include the major arteries of US1, State highway A1A (South Roosevelt Blvd.) and Flagler Avenue and therefore it is considered a reasonable estimate for AADT. This result was then multiplied by 365 in order to arrive at annual vehicle mile traveled (VMT) for all roads in Key West. This VMT data is used in combination with average data for vehicle fuel efficiency and vehicle types provided by the software defaults to calculate total fuel use.

Subsectors included in transportation were:

- total community VMT (as explained above);
- vehicle miles traveled by the city's waste hauler to transport solid waste to the incinerator in Broward County. Since these trips originate at the Stock Island transfer station (the very edge of the city limits) and continue 200 miles each way to the incinerator, they are not accounted for in the state's AADT figures. This service contributed 2,042 tons CO<sub>2</sub>e emissions in the transportation sector, and 0.5% of total community emissions.

*Tourist trains and trolleys which travel through city streets run on propane gas. Although these vehicles are already included in the total VMT estimates and are not considered as a separate sector, it is interesting to note the comparison in actual emissions from these vehicles in FY05 versus emissions that would have been created by the same vehicles running on diesel fuel: 493 tons eCO<sub>2</sub> for propane versus 717 tons for diesel fuel, a 45% difference.*



<sup>17</sup> FDOT data on VMT was only available for calendar year 2006. This same figure was applied as the best estimation for FY05.

## **Waste**

Historically, municipal solid waste (MSW) from Key West was sent to a landfill on Stock Island from 1932 until approximately 1987, at which time the Southernmost Waste to Energy (SWTE) plant was installed at the Stock Island site. From 1987 until approximately 1994 the ash generated from the SWTE was put into the landfill site. The landfill was permanently closed and capped per Florida Department of Environmental Protection (FDEP) consent order in two phases between 1992-1994. The SWTE facility continued to operate until 2002, at which time the City Commission voted to close it down rather than pay for retrofits to bring it up to current federal emissions regulations.

Since 2002, a transfer station has been in operation at the Stock Island site, and all municipal solid waste (MSW) is transported 200 miles to an incinerator in Pompano Beach, FL. A new and larger transfer station on Rockland Key (MM 10) was approved by the City Commission in 2007 and is currently being built.

Total community waste generated in FY05 was 60,835 tons, as provided by the city Public Works department. This represents 14,260 tons of CO<sub>2</sub>e emissions created from the waste disposal technology of incineration, or 3.6 % of total community emissions.

*If we were to add the emissions associated with hauling the waste to the mainland, as explained in the Transportation sector, total Waste emissions would equal 16,302 tons. Since we have already included these emissions under the Transportation sector, they are not counted again under the Waste sector.*

*As noted in the Waste section of the Municipal Government Inventory, any increase in recycling, composting and/or mulching activities would divert these materials from the waste stream and thereby reduce emissions associated with incineration and in the case of organic waste, transportation emissions from hauling to the mainland as well.*

## **Stock Island Landfill**

Although closed and capped since 1994, the Stock Island Landfill was considered as a contributing source of total community of greenhouse gas emissions, since methane produced in landfills is a potent greenhouse gas 21 times stronger than carbon dioxide. While some landfills have a methane recapture system in place to recover these emissions by either burning them off or in some cases, generating electricity with the methane, the Stock Island landfill has no such system in place.

The landfill was completely unregulated since its opening in 1932 until the 1970s, and therefore the composition of its lifetime contents is difficult to estimate. CH2MHill, the project engineering company responsible for closing the landfill, provided methane and carbon dioxide estimates for 2005 (calendar year) using the USEPA LandGem model (v 3.02.)

Emissions from the landfill totaled 8,800 tons CO<sub>2</sub>e, or 2.2% of total community emissions. Since the landfill has been closed for so many years, and since the calculations were based on very rough estimates of waste composition and tonnage, the continuing yearly amount of emissions is assumed to be constant unless measures are taken to recapture methane.

## ***C. Forecast & Target***

A forecast was conducted of emissions predicted between the baseline year of FY05 and the target year of 2015 for both the municipal and community inventories. Forecasting methodology and accuracy, by definition, is a “best guess” estimation. 2015 was chosen as the forecast year, to offer a prediction that was far enough in the future to allow time to plan and implement changes, yet soon enough to impress the fact that action must be taken sooner than later if we are to achieve our stated goals. A target goal of 15% below baseline levels by 2015 is recommended for both the community and municipal action plan.

IPCC and other research mentioned earlier in this report suggests that we would need to achieve as much as an 80% reduction by the year 2050 in order to reverse global warming and stabilize the climate. The Sierra Club has developed the “2% Campaign” which states a goal of reducing emissions 2% per year for the next 40 years in order to achieve the necessary 80% reductions by 2050. Key West’s 15% by 2015 goal is close to this strategy and yet slightly more aggressive – consistent reductions of 2.8% per year will be required to meet the target goal. Using this strategy, interim goals may be employed prior to 2015 as a means of monitoring progress, as well as more far ranging goals to strive for beyond 2015.

### ***1. Community Forecast***

Given that Key West’s population has stagnated and actually declined slightly since the 2000 census, and the fact that there are strict limitations on available land and permits for new development, we do not expect any measureable increase in population by the target year. Development that has occurred recently and will likely continue to occur involves “re-development” of existing structures as opposed to building from scratch. This trend may indeed have an impact on predicted GHG emissions as well as the influence that city government can have on potential reduction measures. Re-developments tend to be larger square footage containing more energy intensive amenities, leading to a per capita increase in city-wide energy consumption and associated emissions. The only known potential new developments are buildings proposed for the Florida Keys Assisted Care Coalition, the Bahama Conch Community Land Trust at the Truman Waterfront, and any new affordable housing units that may be built in the city.

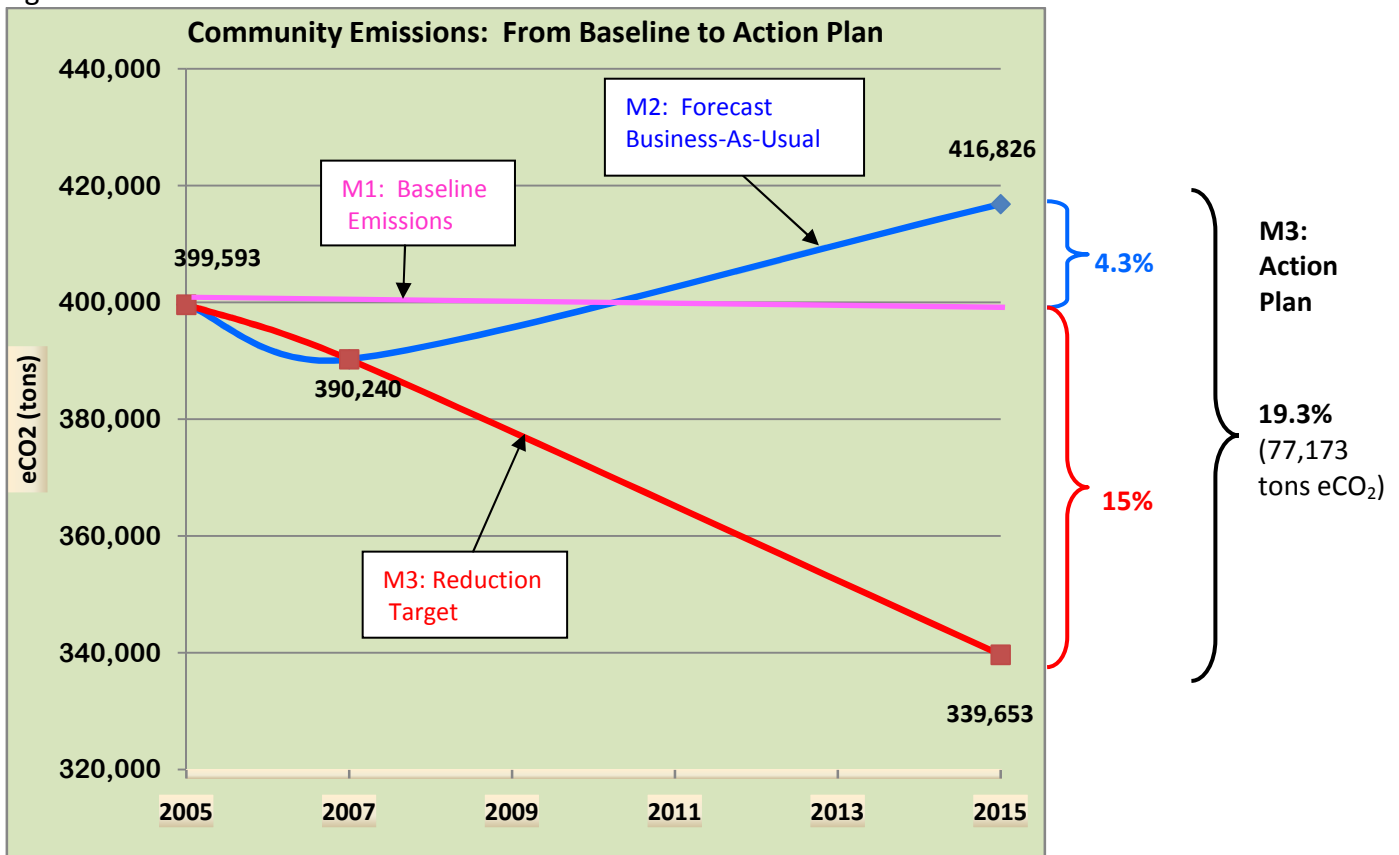
The community forecast was calculated using the U.S. Energy Information Administration’s predictions of changes in per capita energy electricity use in the commercial and residential sectors for the south Atlantic region, as well as per capita fuel use for gasoline and diesel. The city Public Works Department was also consulted for predictions of waste disposal. For details on these calculations, please see Appendix D.

Using these data sources, it is predicted that without taking any steps to reduce greenhouse gas (GHG) emissions, the city will be responsible for emitting 416,826 tons of CO<sub>2</sub>e by the target year 2015, an increase of 4.3 % from the baseline FY05. Taking a straight annual percentage increase from FY05 to 2015 produces total expected emissions of 426,179 tons; however, our analysis of the interim year FY07 showed an actual decrease of 9,352 tons of emissions. Therefore, this amount was deducted from the projected 426,179 tons in order to arrive at the net projection of 416,826 tons.

The interim year of FY07 was measured in order to show any changes in emissions since the baseline year of FY05. It may seem contradictory that projected emissions are expected to rise by 2015 when the last two years have shown an actual decline. However, this may be an anomalous trend, and not indicative of what is likely to occur in the future. In October, 2005, the month following the close of the baseline year FY05, Hurricane Wilma hit Key West, flooding over 50% of homes and vehicles and severely impacting the city's infrastructure. Many people found themselves unable to live in their homes for months and even years while repairs were being done. Hotels, businesses and tourism were also affected by this event. Another contributing factor may be the real estate "boom and bust" scenario that has occurred over the past few years. Many properties were bought on speculation with the intention to re-sell, and due to the declining real estate market as well as the effects of the hurricane, many of these properties have stagnated on the market and/or foreclosed, and consequently have remained empty. Therefore, it is difficult to attribute the decrease in emissions between FY05 and FY07 as a general trend that will continue in the future.

Figure 18 below illustrates the difference between baseline FY05 emissions (M1) and the forecasted "business-as-usual" projection by 2015 (M2). M3 shows the necessary reductions if we are to achieve a recommended target goal of 15% below FY05 levels by 2015. A total reduction of 19.3% is necessary to overcome forecasted increases in addition to the 15% target goal. This amounts to a total reduction goal of 77,173 tons of CO<sub>2</sub>e emissions.

Figure 18

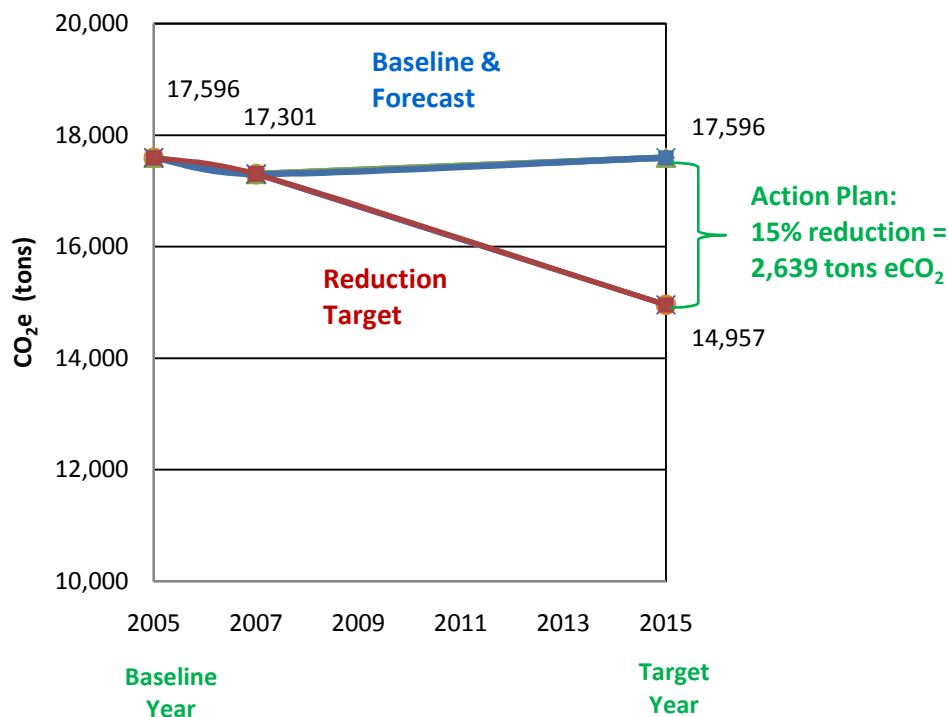


## 2. Municipal Forecast

As stated earlier in this report, the forecasted business-as-usual emissions from municipal government activities are not anticipated to change substantially by 2015. Given that the community's population is not expected to increase, it follows that government operations and infrastructure which serve the community would also not change substantially. Moreover, the average grid electricity emissions factors programmed into the CACP software account for expected increases in efficiencies to the electricity grid for our region, which serves to reduce the GHG emissions per kilowatt hour of electricity use. Given that over 50% of our municipal emissions come from electricity use, any potential increases in overall municipal energy use would likely be off-set by factoring in the cleaner fuel mix of the electricity grid. Based on these assumptions, the FY05 baseline of 17,596 tons of CO<sub>2</sub>e was used as the forecasted total emissions for the target year of 2015, as seen in Figure 19 below.

Using the same target reduction figure that was used for the community inventory - 15% below baseline levels by 2015 - the municipal government emissions must be reduced by 2,639 tons of CO<sub>2</sub>e to achieve that goal. This equates to a 2.2% reduction per year, or 377 tons.

Figure 19: Municipal Emissions Forecast & Reduction Target



### *III. Conclusions and Next Steps*

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Investment into greenhouse gas reduction methods benefits the city through both direct savings in electricity and fuel purchase costs, and by contributing to overall reduction of greenhouse gas and local air pollution.

The vast majority of greenhouse gas emissions from the city are from the activities of private residential and commercial entities. The influence of the City on these emissions varies depending on the source of the emission. Through policy decisions about land use and development, investments in public transit, energy-efficient building practices, waste reduction and recycling programs, the City can influence the behavior of non-City entities both directly and indirectly.

In order to drive the Cities for Climate Protection (CCP) Campaign forward through Milestones 2-5, a Climate Protection Task Force should be developed. This inventory report concludes a recommended community reduction target of 15% by 2015, as outlined above, which is determined to be an ambitious yet realistic and achievable goal. The Climate Protection Task Force may wish to revise this goal and/or set additional targets for both municipal and community reductions.

Due to the individualized nature of the CCP Program, the timeframe for which Key West develops its proposed Climate Protection Task Force and Local Action Plan is completely determined by the city. This process will be influenced by the amount of time the task force is able to commit to planning, the amount of resources needed and available for the planning process, and the priority the city places on this campaign relative to other proposed projects and activities. Some cities are able to develop their Local Action Plan within a few months; others take up to, and sometimes more than, one year. The City of Key West will need to evaluate the factors affecting the planning process in this city, and keep in mind that this is a dynamic process that will change with other changes in city operations.

*The most important element to remember is that incorporating CCP initiatives and planning strategies into established projects and other proposed initiatives is usually the best way to ensure its continuation and success.*

#### ***A. Key West's Progress through the CCP Milestones***

##### **Milestone 1 – Conduct a Greenhouse Gas Emissions Analysis: Baseline Inventory and Forecast of Emissions Growth**

The emissions inventory for the City of Key West began in early October 2007 and was completed in January 2008. A detailed analysis for both Community-wide and Municipal sectors has been calculated for a baseline year of FY05 as well as an interim year of FY07. Electricity and fuel consumption, as well as waste data was entered into the CACP software program developed by Torrie Smith Associates. Forecasting data provided by the U.S. Department of Energy and also the Key West Public Works Department has been used to estimate business-as-usual growth projections for energy usage and carbon dioxide production into the year 2015.

## **Milestone 2 – Set a Reduction Target**

This milestone propels the CCP Campaign forward, in that the city will not only be continuing to evaluate its current situation, but also look to the future and plan for sustainability. Strong task force development is key in this process, as is good, working communication between city departments and different sectors of the community to establish priorities and set goals.

The reduction target is the specific greenhouse gas (GHG) emissions reduction goal that Key West will aim to achieve by the year 2015. If Key West decides to follow the recommended 15% reduction below baseline levels as suggested in this report, the city will campaign to reduce GHG emissions community-wide from the FY05 baseline of 399,592 tons of CO<sub>2</sub>e per year, to less than 339,653 tons of carbon dioxide equivalents per year by 2015. Likewise, the city government will strive to reduce 2,639 tons of CO<sub>2</sub>e from government operations to meet the recommended 15% reduction target.

There are several issues involved in setting a reduction target. Key West will need to allow for enough time to implement the measures in its Local Action Plan, but note that the farther out the target year is, the more emissions Key West might be pledging to reduce due to a longer period of accumulated growth in emissions. A more distant target year gives the city more time, but also increases the amount that needs to be reduced.

## **Milestone 3 – Develop a Local Action Plan for Key West**

The Local Action Plan is a description of actions – policies, programs, measures – that Key West has already taken and plans to take to meet its GHG reduction target.

### **The Local Action Plan may include:**

1. The results of:
  - The baseline emissions inventory (Milestone 1)
  - The emissions forecast (Milestone 1)
  - The emissions reduction target stating the reduction goal for Key West (Milestone 2)
2. The set of GHG reduction actions:
  - Existing actions that will be continued (streetlight and traffic light upgrades; use of biodiesel in city fleets, etc.)
  - New or proposed actions that together with existing programs will reach the GHG reduction target
3. Implementation strategies:
  - Identifying costs, responsibilities, schedules, funding sources
  - Procedure for monitoring the progress made toward the achievement of the target and the status of implementation of the GHG reduction actions

## **Step 1 – Quantify GHG Reductions of Existing Measures**

Any actions the city has taken since the baseline year of FY05 which have an effect of reducing GHG emissions, whether or not that was the primary motivation for implementing the action, should be counted and quantified. Quantifying the GHG reduction benefits helps analyze how close the existing measures are bringing Key West towards its emissions reduction target. Data collection forms are provided in the CCP Toolkit, and information needed includes the type of fuel affected and the amount of energy saved from each measure implemented. Entering the

data into the CACP software 'Measures' section will calculate GHG reductions and cost savings achieved from each measure.

### **Step 2 – Compare to the Target**

After quantifying the emissions reductions achieved from existing measures, Key West must determine how far it has come in approaching its target and how far it still has to go. Reports generated from the software automatically perform this step by displaying the GHG reductions achieved from each measure and comparing it against the baseline emissions and the reduction target.

### **Step 3 – Choose New Measures**

Results from the GHG inventory and forecast will be used to look for the best areas and opportunities for reaching Key West's reduction target. Identifying where big numbers occur, and also information on end-use energy consumption will help to further identify opportunities for emissions reductions. Since electricity is the main source of GHG emissions in the Community inventory, it will be important for Key West to focus action around reducing electricity consumption in private residences and commercial establishments. Determining what the electricity is used for (end-use consumption), whether it is lighting, air conditioning, pool heating, or other purposes, will help show what measures need to be taken to reduce consumption. Investments and opportunities to create locally produced clean energy, through increased solar, wind or hydro power, will also play an important role in reaching or exceeding the target reductions.

Vehicle use, transportation planning, and the current system of waste disposal should also be considered when identifying opportunities for reducing emissions. Promotion of alternative fuels, improved public transit systems and enhancement of bicycle and pedestrian facilities, as well as waste reduction and increased recycling efforts, will all positively impact the carbon footprint of the city. Many of these measures will have co-benefits of improving livability and quality of life for Key West residents and visitors.

In the case of the Municipal inventory, electricity for buildings, lighting, water and sewer management comprise the largest share of emissions. For all of these sectors, implementation of a comprehensive system of tracking and oversight related to energy consumption will reveal the best opportunities for energy conservation, emissions reductions and cost savings associated with energy use. Likewise, a detailed analysis of the city's vehicle fleet, and government contracted waste system may provide insight into the best opportunities for reductions in these sectors. *Again, the task force will be important for brainstorming a list of potential projects and programs, and evaluating the ICLEI-suggested measures for feasibility in Key West.* Not all of the measures need to produce big emissions reductions. Some may be included primarily for their educational value or for other reasons that make sense for Key West.

**Additional criteria that can be used to rate potential measures include:**

- Cost vs. savings
- Staffing requirements
- Political and public support
- Impact on raising public awareness
- Co-benefits such as improving air quality, reducing traffic congestion, creating jobs and other economic opportunities, and saving money.

**Step 4 – Quantify GHG Reductions of New Measures**

Data collection forms in the CCP Toolkit help gather the necessary information to estimate GHG reduction potential for each proposed measure. These sheets, along with the CCP software and help from appropriate departments, will guide the task force in their recommendations for a strong, attainable Local Action Plan.

**Step 5 – Create the Final Action Plan Report**

Once steps 1-4 are complete, a report of the Local Action Plan will be created. A draft of the Action Plan will be sent out for peer review and community comment, and a final draft will be presented and ultimately adopted by the City Commission.

**Milestone 4 – Implementing the Local Action Plan**

It is important to ensure the effective accomplishment of Milestone 4 so that the measures and programs selected for Key West's Local Action Plan will be implemented effectively and produce the desired results. Suggestions of how to include details for implementation such as schedules, budgets, identification of funding sources, assignment of responsibility to agencies and staff, and methods for monitoring and evaluating progress follow in the next section.

***Key areas of the implementation section:***

**1. Administration and Staffing**

- Overall program management (project facilitator(s))
- Communication and coordination (task force)
- Adequate resources (volunteers/student interns)
- Ensuring implementation of existing measures (follow-through)
- Coordinator position may be specified in Local Action Plan

**2. Financing and Budgeting**

- What actions can be made part of existing projects or expenditures? (e.g. policies favoring bicycles and pedestrian transit over motor vehicles)
- What actions will require new expenditures?
- Can funds be found from the existing municipal budget?
- Energy-saving measures will likely provide enough financial savings to fund implementation of other measures in the Plan, if the savings are designated
- Where to go when municipal resources fall short (loans, grants, public-private partnerships, etc.)

### **3. Developing a Timeline**

- Overall schedule should meet reduction target date
- Integrate schedule with existing processes and responsibilities
- Provide ample time for external review and input

### **4. Public Involvement in the Implementation Process**

- Creating a sense of ownership
- Recruit volunteers/interns to assist in presenting the Plan to the public
- Invite public comment

### **Milestone 5 – Monitor Progress and Report Results**

This is an ongoing process that needs to be built into the implementation of the Local Action Plan. It is important to monitor the progress being made toward the target and the status of implementing the GHG reduction actions so the community can feel proud and motivated by its accomplishments, and adjustments can be made to keep on track. Collecting data on all implemented measures and running them through the CACP software on a regular basis is the best way to create progress reports.

## ***B. Developing a working Climate Protection Task Force for Key West***

### **Putting together a Climate Protection Task Force**

Forming a task force is the most effective way to define and delegate the tasks that go into developing and implementing the Local Action Plan. A task force can also be an effective means to involve parties such as residents, businesses, and community groups in the process. The success of a strong Local Action Plan is largely dependent on the structure and organization of those developing it. Formal city commission and mayoral resolutions adopting the emissions reduction target help get the momentum going, but bringing all the necessary and appropriate representatives from the community to the table is critical to the process.

There are a number of models and approaches to learn from when thinking about task force and Plan development. Some involve primarily city staff, while others tap heavily into community resources.

### **Brief Examples:**

**Austin, TX** created an interdepartmental task force with city staff from the Planning, Environmental and Conservation Services Department, including a planner, an economist, an air quality manager, a demand side management program manager, and an editor.

**Fort Collins, CO** hired a private consultant to assist city staff in developing the technical and logistical aspects of their Local Action Plan and to work with a Project Advisory Committee that oversaw development of the Plan. Fort Collins' Project Advisory Committee was formed to build consensus and ensure that programs were coordinated. It was comprised of council members, interested citizens, and key staff from Facilities, Fleets, Light and Power, Natural Resources, Parks and Recreation, Transportation Planning, and Traffic Operations departments.

**Minneapolis and St. Paul, MN** combined efforts to produce the Minneapolis – St. Paul Urban CO2 Reduction Plan in October 1993. An Executive Steering Committee made up of key decision-makers was created to direct the development of the Plan. The committee included mayors and other elected officials from both cities, representatives from Hennepin and Ramsey County Boards of Supervisors, executives from Northern States Power utility and other local businesses, and representatives from community and environmental organizations. Because of this inclusive committee process, stakeholders derived a feeling of ownership with the project. As a result, Northern States Power entered into an agreement with the City of St. Paul to provide capital for a comprehensive municipal energy-efficiency retrofit project at zero percent financing.

**Portland, OR** set up a Technical Team – comprised of city, utility and state energy office staff – to assist with the technical aspects of the work. It also set up a Policy Committee with representatives from utilities, the transit agency, METRO, State Energy Office, Mayor’s Office and local businesses. Members of both committees accompanied the lead staff in presenting the final plan to the planning commission and at council hearings.

### ***Involve Key Players and the Community***

Whatever route Key West chooses to take, it is important to involve relevant players and ensure the cooperation and buy-in of appropriate departments and other entities. Key players include department heads and elected officials, who will be involved in plan preparation and be responsible for plan approval and implementation. The success of Key West’s Local Action Plan will more than likely depend on strong community support. With the majority of GHG emissions coming from the commercial sector, and a large percentage from private residences, it is important to build community support and public participation.

### **Strategies to ensure effective citizen involvement:**

1. Identify key individuals, businesses, institutions, and decision makers to be brought in, e.g. public officials, major employers, utilities, environmental and neighborhood organizations, Chamber of Commerce
2. Establish a community task force to work with municipal staff and elected officials
3. Utilize volunteers from the community to consult in formulating the plan and in presenting it to the public

### **Probable Stakeholders in Key West:**

- |                                   |                                   |
|-----------------------------------|-----------------------------------|
| - Keys Energy Services            | - Monroe County Housing Authority |
| - Florida Keys Community College  | - National Marine Sanctuary       |
| - Monroe County School District   | - Keys Hydro Power                |
| - Chamber of Commerce             | - Lodging Association             |
| - Navy and Coast Guard            | - Developers/building trade       |
| - Monroe County Extension Service |                                   |

## **Get the Word Out**

As with monitoring progress, this step is really an ongoing process. Publicizing Key West's commitment to climate protection can help gain public support at an early stage, and might also help identify people willing to volunteer their services.

*Effective means of outreach include:*

- Public Forums and Town Meetings
- Lecture series
- Earth Day Activities
- Media Coverage/bi-weekly or monthly newspaper article
- Awareness/education in schools
- Awards to local businesses for energy-efficiency and innovative carbon reduction initiatives
- Public Education displays in libraries, city buildings, etc.

## **Questions for Key West to think about while going through the Milestones:**

- Which Milestones or other steps can be finished in the next six months?
- What does the task force/city need to achieve this goal?
- What barriers might arise in reaching Plan completion and implementation?
- What ideas do we have to get past these barriers?
- How do we get political and staff buy-in and generate concrete assistance for this work?
- What existing planning processes might this work be able to be integrated into?
- How do we get the community involved in our climate protection effort?
- How can we build public awareness for climate protection?
- How might recognition and celebration of successes be built into the process?

## *IV. Appendices*

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## APPENDIX A

### *List of Figures & Tables*

<u>Figure</u>	<u>Page</u>
Figure 1	The Greenhouse Effect..... 4
Figure 2	Global Temperature and Carbon Dioxide Concentrations ..... 5
Figure 3	Forecast of CO <sub>2</sub> Parts per Million ..... 6
Figure 4	Key West with 1.5 Meters Sea Level Rise..... 7
Figure 5	Anticipated Sea Level Rise and Horizontal Advance of the Waterline..... 8
Figure 6	Map of Signatories of US Mayor’s Climate Protection Agreement ..... 11
Figure 6.1	Total GHG Emissions by Year ..... 16
Figure 7	FY05 Community GHG Emissions by Sector ..... 17
Figure 8	FY05 Municipal GHG Emissions by Sector..... 17
Figure 8.1	Baseline & Forecasted GHG Emissions ..... 18
Figure 9	FY05 Municipal GHG Emissions by Energy Source ..... 20
Figure 9.1	FY05 Municipal Profile by Sector ..... 20
Figure 10	FY05 and FY07 GHG Emissions from City Buildings & Facilities..... 22
Figure 11	FY05 and FY07 GHG Emissions from Streetlighting ..... 25
Figure 12	FY05 Community Inventory by Energy Source ..... 27
Figure 13	FY05 Community Inventory by Sector..... 27
Figure 14	FY05 Commercial GHG Emissions by Source..... 28
Figure 15	FY05 Commercial GHG Emissions..... 28
Figure 16	FY05 Residential GHG Emissions by Source ..... 29
Figure 17	GHG Emissions from Propane vs. Diesel for Trains and Trolleys..... 29
Figure 18	Community GHG Emissions Baseline, Target and Forecast..... 32
Figure 19	Municipal GHG Emissions Baseline, Target and Forecast..... 33

<u>Table</u>	<u>Page</u>
Table 1	FY05 Municipal GHG Emissions by Sector..... 22
Table 2	FY05 and FY07 GHG Emissions from Municipal Buildings & Facilities ..... 23
Table 3	FY05 GHG Emissions from Municipal Vehicle Fleet..... 24
Table 4	FY05 and FY07 GHG Emissions from Streetlighting..... 25
Table 5	FY05 GHG Emissions from Water/Sewer..... 26

## APPENDIX B

### *Glossary of Terms & Abbreviations*

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**Anthropogenic** - effects, processes, objects, or materials that are derived from human activities, as opposed to those occurring in natural environments without human influences.

**Average Grid Electricity Emissions Factors** - These emission factors specify the emissions per kilowatt-hour of the annual average kilowatt-hour produced in the electricity region specified. Default values are provided for 1990 through 2020. Essentially, these average kilowatt-hour factors have been derived by dividing emissions in each NERC region by end use electricity. Average grid electricity emission factors are the average of emissions generated per kilowatt-hour over an entire year, taking into account fuels used and generating and emission control technologies in use in each plant.

**Atmosphere**—The atmosphere is the gaseous envelope surrounding a planet. The Earth's atmosphere consists primarily of nitrogen (79.1% by volume) and oxygen (20.9% by volume), with carbon dioxide (CO<sub>2</sub>) representing approximately 0.03%. In addition, the atmosphere contains traces of argon, krypton, xenon, neon, and helium, plus water vapor, traces of ammonia, organic matter, ozone, various salts, and suspended solid particles.

**Biodiesel** - is a domestically produced, renewable fuel that can be manufactured from vegetable oils, animal fats, or recycled restaurant greases. Biodiesel is safe, biodegradable, and reduces greenhouse gases and other air pollutants such as particulates, carbon monoxide, hydrocarbons, and air toxics. Blends of 20% biodiesel with 80% petroleum diesel (B20) can generally be used in unmodified diesel engines; however, users should consult their OEM and engine warranty statement. Biodiesel can also be used in its pure form (B100), but may require certain engine modifications to avoid maintenance and performance problems and may not be suitable for wintertime use. Users should consult their engine warranty statement.

**Carbon Dioxide**—Carbon dioxide, abbreviated CO<sub>2</sub>, is essential to living systems and released by animal respiration, decay of organic matter and fossil fuel burning. It is removed from the atmosphere by photosynthesis in green plants. The amount of CO<sub>2</sub> in the atmosphere has increased by about 25% since the burning of coal and oil began on a large scale. Atmospheric carbon dioxide varies by a small amount with the seasons, and the ocean contains many times the amount of the gas that exists in the atmosphere.

**Climate**—The term climate represents average weather together with its variability of representations of the weather conditions for a specified area during a specified time interval (usually decades or longer).

**Criteria Air Pollutants (CAPs)**—The term criteria air pollutants refers to pollutants that are regulated under the U.S. Clean Air Act. As with carbon dioxide, the major sources of these pollutants are fossil fuels. Most measures that reduce carbon dioxide emissions also reduce criteria air pollutants. Criteria air pollutants include nitrogen oxides (NO<sub>x</sub>), volatile organic compounds (VOCs), carbon monoxide (CO), sulfur oxides (SO<sub>x</sub>), and particulate matter smaller than ten microns in diameter (PM-10). The CACP software provides estimated emissions of CAPs as well as GHGs for emissions analyses and reduction benefits of measures.

**FDEP - Florida Department of Environmental Protection** - The Department of Environmental Protection is the lead agency in state government for environmental management and stewardship and is one of the more diverse agencies in state government, protecting our air, water, and land.

## **FDOT – Florida Department of Transportation**

**Equivalent Carbon Dioxide (CO<sub>2</sub>e)**—Equivalent carbon dioxide, abbreviated as CO<sub>2</sub>e and also known as global warming potential (GWP), is a unit that allows emissions of greenhouse gases of different strengths to be added together and framed in terms of comparative units. For carbon dioxide itself, emissions in tons of CO<sub>2</sub> and tons of CO<sub>2</sub>e are identical, whereas for methane, an example of a stronger greenhouse gas, one ton of methane emissions has the same GWP as 21 tons of CO<sub>2</sub>. Thus 1 ton of methane emissions can be expressed as 21 tons CO<sub>2</sub>e.

**GHG (Greenhouse Gas) Emissions and the Greenhouse Effect**—The Earth’s climate is determined by a delicate balance between the solar energy that arrives from space and the heat energy that the Earth creates from the sun’s rays. The energy that arrives from space should always equal the energy that the Earth emits back to space. When something disturbs this balance, our climate adjusts by cooling or warming the Earth to return things to normal. A portion of outgoing heat energy is absorbed in the atmosphere by greenhouse gases such as water vapor, carbon dioxide, methane, and nitrous oxide. If these trace gases were not present, the average temperature on the Earth’s surface would be -32 degrees Fahrenheit, and life as we know it would not have evolved here. But the natural greenhouse effect keeps the average global surface temperature at a comfortable 59 degrees Fahrenheit.

Today, the atmospheric concentration of the most important greenhouse gas, carbon dioxide, is higher than it has been in the past 650,000 years. Scientists participating in the British Antarctic Survey have succeeded in charting the atmospheric concentration of carbon dioxide over the last 800,000 years. Their research has shown that temperature unfailingly rises and falls in response to carbon dioxide levels. This increase is the result of an increased reliance on fossil fuels and deforestation, which has caused an imbalance between the absorption and release of carbon dioxide by vegetation. Other greenhouse gases, also found in the atmosphere in increasing amounts, are methane, nitrous oxide and the chlorofluorocarbons (CFCs).

**Global Warming**—Global warming describes the recent trend of increasing average global surface and tropospheric temperatures that scientists believe is caused by increased emissions of human-induced greenhouse gases. The greenhouse gases (CO<sub>2</sub>, methane, nitrous oxides and CFCs) are emitted into the atmosphere and increase the atmosphere’s “entrapment” of heat.

**ICLEI – Local Governments for Sustainability** is an international association of local governments dedicated to solving local, regional, and global environmental problems through cumulative local action. There are over 600 ICLEI members comprising cities, towns, counties, and their associations from around the world.

**IPCC—Intergovernmental Panel on Climate Change**—The Intergovernmental Panel on Climate Change (IPCC) was jointly established in 1988 by the World Meteorological Organization and the United Nations Environment Programme to:

- Assess available scientific information on climate change;
- Assess the environmental and socio-economic impacts of climate change; and
- Formulate response strategies.

It has emerged as the predominant international forum for the development of scientific knowledge and policy advice on matters related to climate change. Its periodic Assessment Reports are relied upon by governments to guide policy making on this issue. The IPCC's Fourth Assessment Report in 2007 projects that the Earth's average surface temperature will increase between 4.3° and 11.5°F (2.4°-6.4°C) between 1990 and 2100 if no major efforts are undertaken to reduce the emissions of greenhouse gases (the "business-as-usual" scenario). Furthermore the Fourth Assessment Report also found that "Warming of the climate system is **unequivocal**" and "Most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* due to the observed increase in **anthropogenic** greenhouse gas concentrations."

**Kyoto Protocol**—The Kyoto protocol was adopted by consensus at the third session of the Conference of the Parties (COP-3) in December 1997 in Kyoto, Japan. When ratified by a certain percentage of participating countries, it contains legally binding emissions targets for developed countries in the post-2000 period. By arresting and reversing the upward trend in greenhouse gas emissions that started in these countries 150 years ago, the Protocol promises to move the international community one step closer to achieving the Convention's ultimate objective of preventing "dangerous anthropogenic [human-induced] interference with the climate system."

According to the Protocol, developed countries commit themselves to reducing their collective emissions of six key greenhouse gases by at least 5%. This group target will be achieved through cuts of 8% by Switzerland, most Central and East European states, and the European Union (the EU will meet its target by distributing different rates among its member states); 7% by the US; and 6% by Canada, Hungary, Japan, and Poland. Russia, New Zealand, and Ukraine are to stabilize their emissions, while Norway may increase emissions by up to 1%, Australia by up to 8%, and Iceland 10%. The six gases are to be combined in a "basket", with reductions in individual gases translated into "CO<sub>2</sub> equivalents" that are then added up to produce a single figure. In 2005, the Kyoto Protocol went into effect after 141 industrialized countries signed on to the agreement.

**LED: Light Emitting Diode** - A Light Emitting Diode (LED) is a semiconductor device which converts electricity into light. Each diode is about 1/4 inch in diameter and uses about ten milliamps to operate at about a tenth of a watt. LEDs are small in size, but can be grouped together for higher intensity applications. LEDs are better at placing light in a single direction than incandescent or fluorescent bulbs. Because of their directional output, they have unique design features that can be exploited by clever designs. LED lights are more rugged and damage-resistant than compact fluorescents and incandescent bulbs. LED lights don't flicker. They are very heat sensitive; excessive heat or inappropriate applications dramatically reduce both light output and lifetime.

**Methane**—Methane, abbreviated CH<sub>4</sub>, accounted for about 8.6% of U.S. GHG emissions in 2005. Methane is produced by anaerobic decomposition of solid waste in landfills and sewage treatment facilities, wetlands and rice paddies, as a byproduct of fossil fuel energy production and transport and also

from outgassing in livestock. It is also the principle constituent of natural gas and can leak from natural gas production and distribution systems and is emitted in the process of coal production. The methane concentration in the atmosphere has been rising steadily for several centuries, keeping pace with the increase in the world population and expansion of the world economy.

**MMBTU- million British Thermal Units** - A standard unit of measurement used to denote both the amount of heat energy in fuels and the ability of appliances and air conditioning systems to produce heating or cooling. A BTU is the amount of heat required to increase the temperature of a pint of water (which weighs exactly 16 ounces) by one degree Fahrenheit. Since BTUs are measurements of energy consumption, they can be converted directly to kilowatt-hours (3412 BTUs = 1 kWh) or joules (1 BTU = 1,055.06 joules). A wooden kitchen match produce approximately 1 BTU, and air conditioners for household use typically produce between 5,000 and 15,000 BTU.

**Municipal Solid Waste (MSW)** - The U.S. Environmental Protection Agency defines MSW to include durable goods, containers and packaging, food wastes, yard wastes, and miscellaneous inorganic wastes from residential, commercial, institutional, and industrial sources.

**PPM – Parts per million**

**US EPA LandGem Model** - The Landfill Gas Emissions Model is an automated estimation tool with a Microsoft Excel interface that can be used to estimate emission rates for total landfill gas, methane, carbon dioxide, nonmethane organic compounds, and individual air pollutants from municipal solid waste landfills.

## APPENDIX C

### *Information Sources*

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Both sections of the inventory involve collecting data and other technical information from utility companies, regional planning agencies, municipal utility billing records, and some Internet sources. The following is a comprehensive list of the data sources used for the inventory and forecast. Individuals with questions pertaining to this information can either contact:

Jody Smith Williams, Program Assistant

Phone: 305-304-2064

Email: [kwjody@yahoo.com](mailto:kwjody@yahoo.com) or

Annalise Mannix, Environmental Projects Manager, City of Key West

Phone: 305-809-3747

Email: [amannix@keywestcity.com](mailto:amannix@keywestcity.com)

or direct correspondence to the below listed persons or websites.

#### **ICLEI - Local Governments for Sustainability, USA Inc.**

436 14th Street, Suite 1520

Oakland, CA 94612

Phone (510) 844-0699

Fax: (510) 844-0698

e-mail: [iclei-usa@iclei.org](mailto:iclei-usa@iclei.org)

Website: [www.iclei.org/us](http://www.iclei.org/us)

Contacts: Wesley Look, Susan Ode, Katherine Jarvis-Shean

#### **Torrie Smith Associates**

95 Beech Street

Ottawa, Ontario K1S 3J7

Phone: (613) 238-3045

Fax: (613) 238-8776

Website: [www.torriesmith.com](http://www.torriesmith.com)

### *C-1 Community Inventory Data Sources*

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#### **Community Electricity Data**

Lynne Tejeda, General Manager

Organization: Keys Energy Services

P.O. Box 6100, Key West, FL 33041-6100

Phone: (305) 295-1040

Email: [Lynne.tejeda@keysenergy.com](mailto:Lynne.tejeda@keysenergy.com)

Peggy Walls, Assistant Director of Finance

Phone: (305) 295-1016

Email: [Peggy.walls@keysenergy.com](mailto:Peggy.walls@keysenergy.com)

**Community Propane Data**

*Name:* John Acquaviva, General Manager

*Organization:* Suburban Propane (the only company to supply trains and trolleys)

*Address:* 726 Catherine Street, Key West, FL 33040

*Phone:* 305-296-2411

*Name:* Mimi and Ernie Oskey, owners

*Organization:* All Keys Gas Service

*Address:* P.O. Box 420060, Summerland Key, FL 33042

*Phone:* 305-745-1122

*Name:* Chuck (last name unknown), Manager

*Organization:* AmeriGas

*Address:* 1718 N. Roosevelt Blvd, Key West, FL 33040

*Phone:* 305-294-3527

*Name:* Joe Moyer

*Organization:* Historic Tours of America, Fleet Manager

*Phone:* 305-304-4684

**Community Road Transportation**

*Name:* Gordon Morgan, Transportation Statistics

*Organization:* Florida Department of Transportation (FDOT)

*Phone:* 850-414-4730

*Email:* [Gordon.Morgan@dot.state.fl.us](mailto:Gordon.Morgan@dot.state.fl.us)

*Name:* Tina Hatcher

*Organization:* Florida Department of Transportation (FDOT)

*Phone:* 850-414-4706

*Email:* [Tina.Hatcher@dot.state.fl.us](mailto:Tina.Hatcher@dot.state.fl.us)

*Website:* <http://www.dot.state.fl.us/planning/statistics/default.htm>

**Community Waste Transportation**

*Name:* Greg Sullivan, District Manager

*Organization:* Waste Management, Inc.

*Phone:* 305-296-8297

*Email:* [gsullivan@wm.com](mailto:gsullivan@wm.com)

**Community Marine Transportation**

*Name:* Richard Brevaldi, Manager

*Organization:* Garrison Bight Marina

*Phone:* 305-294-3093

*Name:* Roger Greene

*Organization:* King's Pointe Marina (formerly Conch Harbor)

*Phone:* 305-294-4676 ext. 103

*Email:* [roger.greene@kingspointemarina.com](mailto:roger.greene@kingspointemarina.com)

*Name:* Mark (last name unknown), Manager  
*Organization:* A&B Marina \*  
*Phone:* 305-294-2535

*Name:* Joanna (last name unknown)  
*Organization:* Sunset Marina  
*Phone:* 305-296-7101

*Name:* Helen Stanley, Emergency Planning Program Manager  
*Organization:* US Navy \*  
*Phone:* 305-293-2060

*Name:* Lieutenant Michael Bell, Public Information Officer  
*Organization:* US Coast Guard \*  
*Phone:* 305-292-8805  
*Email:* [Michael.s.bell@uscg.mil](mailto:Michael.s.bell@uscg.mil)

*Name:* Mark Tait  
*Organization:* City of Key West, City Marina Manager  
*Phone:* 305-293-8370  
*Email:* [mtait@keywestcity.com](mailto:mtait@keywestcity.com)

\* Data was requested from these marinas but not received in time to include in the inventory. However, this information may be useful to include in the future once all data is received.

### **Community Waste Data**

*Name:* RB Havens, Public Works Director  
*Organization:* City of Key West  
*Phone:* 305-809-3751  
*Email:* [rbhaven@keywestcity.com](mailto:rbhaven@keywestcity.com)

### **Community Landfill Data**

*Name:* Bo Bruner  
*Organization:* CH2MHill  
*Phone:* 352-335-5877 ext. 52305  
*Email:* [Bo.Bruner@CH2M.com](mailto:Bo.Bruner@CH2M.com)

*Name:* Tom Kraemer  
*Organization:* CH2MHill  
*Email:* [Tom.Kraemer@CH2M.com](mailto:Tom.Kraemer@CH2M.com)

*Name:* Bill Krumbholz  
*Organization:* Florida Department of Environmental Protection (FDEP)  
*Phone:* 239-332-6975 ext. 155  
*Email:* [Bill.Krumbholz@dep.state.fl.us](mailto:Bill.Krumbholz@dep.state.fl.us)

**Community Indicator Data**

*Variable:* Population

*Publication Title:* South Florida Region Municipal Population and Rates of Growth 1980-2006

*Source:* South Florida Regional Planning Council/US Bureau of the Census and Bureau of Economic and Business Research

*Variable:* Households

*Publication:* US Census 2000

*Source:* US Census Bureau

*Website:* <http://quickfacts.census.gov/qfd/states/12/1236550.html>

*Variable:* Commercial Establishments

*Publication:* Active Business Licenses

*Name:* Buzz Wagner, Director of Research

*Organization:* Key West Chamber of Commerce

*Phone:* 305-294-2587

*Email:* [research@keywestchamber.org](mailto:research@keywestchamber.org)

*Variable:* Commercial Square Footage

*Name:* Rob Shaw

*Organization:* Monroe County Property Appraiser's Office

*Phone:* 305-292-3420

*Email:* [rshaw@mcpafl.org](mailto:rshaw@mcpafl.org)

**Community Forecasting Data**

*Variable:* Growth for all fuel types for all sectors available

*Publication:* Supplement Tables to the Annual Energy Outlook

*Website:* <http://www.eia.doe.gov/oiaf/aeo/supplement/supref.html>

*Variable:* Waste production growth

*Name:* RB Havens

*Organization:* City of Key West, Public Works Director

*Phone:* 305-809-3751

*Email:* [rbhaven@keywestcity.com](mailto:rbhaven@keywestcity.com)

## *C-2 Municipal Inventory Data Sources*

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### **Municipal Electricity Data**

*Name:* Connee Gates

*Organization:* City of Key West, Finance

*Phone:* 305-809-3809

*Email:* [cgates@keywestcity.com](mailto:cgates@keywestcity.com)

*Name:* Ben Gibson

*Organization:* City of Key West

*Phone:* 305-293-6435

*Email:* [bgibson@keywestcity.com](mailto:bgibson@keywestcity.com)

*Name:* Peggy Walls, Assistant Director of Finance

*Organization:* Keys Energy Services

*Phone:* 305-295-1016

*Email:* [Peggy.walls@keysenergy.com](mailto:Peggy.walls@keysenergy.com)

*Name:* Matthew Alfonso, Engineering Services Supervisor (Streetlights contact)

*Organization:* Keys Energy Services

*Phone:* 305-295-1055

*Email:* [Matthew.alfonso@keysenergy.com](mailto:Matthew.alfonso@keysenergy.com)

*Name:* Kevin Hawthorne, Customer Service Supervisor

*Organization:* Keys Energy Services

*Phone:* 305-295-1078

*Email:* [Kevin.hawthorne@keysenergy.com](mailto:Kevin.hawthorne@keysenergy.com)

*Name:* Wayne Davila, Substation Supervisor (Traffic lights contact)

*Organization:* Keys Energy Services

*Phone:* 305-295-1194

*Email:* [Wayne.Davila@keysenergy.com](mailto:Wayne.Davila@keysenergy.com)

### **Municipal Fleet Data**

*Name:* Steve Schipper

*Organization:* City of Key West Fleet Supervisor

*Phone:* 305-809-3905

*Email:* [sschippe@keywestcity.com](mailto:sschippe@keywestcity.com)

*Name:* Myra Wittenberg

*Organization:* City of Key West, Director Department of Transportation

*Phone:* 305-809-3918

*Email:* [mwittenb@keywestcity.com](mailto:mwittenb@keywestcity.com)

*Name:* Margaret Scanlan

*Organization:* City of Key West, Finance

*Phone:* 305-809-3816

*Email:* [mscanlan@keywestcity.com](mailto:mscanlan@keywestcity.com)

*Name:* Greg Sullivan, District Manager  
*Organization:* Waste Management, Inc. (Waste Hauling)  
*Phone:* 305-296-8297  
*Email:* [gsullivan@wm.com](mailto:gsullivan@wm.com)

**Municipal Sewer/Water Data**

*Name:* Greg Smith  
*Organization:* CH2MHill OMI Manager  
*Phone:* 305-292-5102  
*Email:* [Greg.Smith@CH2M.com](mailto:Greg.Smith@CH2M.com)

**Municipal Waste Data**

*Name:* RB Havens, Public Works Director  
*Organization:* City of Key West  
*Phone:* 305-809-3751  
*Email:* [rbhaven@keywestcity.com](mailto:rbhaven@keywestcity.com)

## APPENDIX D

### *Assumptions/Calculations*

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*The following information provides a detailed explanation of how data was compiled and calculated, and what was included/excluded in the analysis.*

### *D-1 Community Inventory Assumptions/Calculations*

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#### **Community Electricity Data**

Keys Energy classifies its customers according to residential or commercial status, with sub categories for large or small commercial users, churches etc. For the purposes of the inventory, community electricity was divided only into residential or commercial. Everything other than residential households (city government, hospital, institutions, military) was considered as commercial use. There is no industrial activity in Key West.

Estimations for the amount of carbon dioxide emitted from electricity consumption are based on the default coefficients in the CACP software for Region 8 – Southeast. Actual billing records with yearly consumption were provided by Peggy Walls from Keys Energy Services.

#### **Inputs for FY05:**

Residential Sector:	170,545,467 kWh
Commercial Sector	232,709,667 kWh*

\*The total commercial sector use was provided by Keys Energy Services. Actual inputs into the software were broken down into records for each of the Top 10 Commercial users (also provided by Keys Energy Services and available as public information on their website); the difference between the Top 10 and the total was entered as a separate record “Other Commercial Energy.”

#### ***Electricity Coefficients***

The default coefficients for electricity that are in the CACP software for the Southeast Region were used. This was because Keys Energy was unable to produce more detailed data on this subject. Keys Energy buys its power from the Florida Municipal Power Agency (FMPA), which is a wholesale power company owned by municipal electric utilities. FMPA generates its power from several sources, as outlined below:

#### **FMPA Fuel Mix:**

Coal:	20.1%
Natural Gas:	26.7%
Distillate:	0.3%
Interchange:	43.0%
Nuclear:	9.5%
Renewables	0.3%

Defining the sources of the “interchange” category is difficult and imprecise and for that reason, it was decided that using the default coefficients in the software would be the most accurate estimation of the fuel mix.

As explained by Keys Energy Services, the "interchange" category includes power purchased directly by FMPPA's All-Requirements Project (ARP), as well as existing purchase power contracts of individual ARP members that were entered into prior to the member joining the ARP. Purchase power generation includes capacity and energy received from other suppliers, such as Progress Energy Florida, Florida Power and Light, Lakeland Electric, Calpine and Southern Company. Some of the fuel sources are known to be natural gas, such as Calpine and Southern. Some purchases are system purchases, such as Progress Energy, FPL and Lakeland, where we cannot specify a fuel source.

### **Community Propane Data**

Propane is sold only through three local commercial providers. Data provided for Key West were best estimates provided by each of the three companies since all three supply the entire Keys. Two of the three companies provided estimated data for calendar year 2005 rather than the fiscal year. Total propane use (minus transportation for trains and trolleys) for FY05 was 1,931,200 gallons.

### **Community Road Transportation Data**

Emissions from personal and commercial vehicles were calculated using annual vehicle miles traveled (VMT) data generated by the Florida Department of Transportation (FDOT.) The most complete and accessible data available was for calendar year 2006; therefore, this data was used to extrapolate the baseline year FY05 and also the interim year FY07.

The FDOT keeps a database for roads based on monitoring sites at certain points on these roads. The database includes 32.75 miles of roads in the city of Key West while total road miles equal 80.1. Although the calculation does not include all roads, it does include the major arteries of US1, State highway A1A (South Roosevelt Blvd.) and Flagler Avenue and therefore it is considered a reasonable estimate for AADT.

AADT was multiplied by the length of the road segments to calculate daily vehicle miles traveled (457,540). This result was then multiplied by 365 in order to arrive at a total of 167,002,100 annual vehicle mile traveled (VMT) for all roads in Key West for 2006. Using the EIA's data for fuel use consumption for the South Atlantic Region, a multiplier of -.32% (a weighted average of the EIA's estimates of gasoline and diesel use) was applied to the 2006 data. The resulting change of 534,400 miles was added and subtracted from the 2006 total, respectively, to estimate FY05 and FY07. Total fuel use for FY05 was determined by using the total VMT in the CACP software default calculations; gasoline: 7,897,254 gallons; diesel: 1,801,105 gallons.

Data on propane use for trains and trolleys was gathered but not entered as a separate record since the default Transport Assistant in the CACP software was used to calculate total fuel consumption for the city. Information comparing the emissions from propane trains and trolleys to potential emissions if they were run on diesel was included in the inventory report as an "informational item" although not included as part of the inventory inputs or outputs.

### **Waste Hauling Data**

Monthly data on hauling municipal solid waste (MSW) to the incinerator in Broward County was provided by Greg Sullivan, Regional Manager for Waste Management, Inc., the company contracted to handle waste collection and disposal for the city. The round-trip mileage to the incinerator is 400 miles. Data for the calendar year 2005 was provided rather than the fiscal year 05; for 07 data was supplied for the fiscal year October 06 through September 07.

In 2005, total mileage for waste hauling was 1,057,540 miles, a total of 2,783 round trips. In FY07 total mileage was 976,800, a total of 2,442 round trips. Waste Management trucks use B5 biodiesel, which is 95% petroleum diesel and 5% biodiesel. Since there is no category in the CACP software for B5, the total was broken down into 95% diesel and 5% B100.

### **Community Marine Data**

An attempt was made to include marine fuel use in the transportation sector analysis, due to the large boating community among recreational, commercial, Navy and Coast Guard. Data was collected from 3 of 4 private marinas; and requests are still pending with the Navy, Coast Guard and the 4<sup>th</sup> private marina as of the completion of the inventory. Therefore, it was considered not worthwhile to include data for this sector until complete data is collected.

### **Community Waste Data**

Most of the waste data for the GHG inventory came from R.B. Havens, Director of Public Works. Total tonnage of waste was provided as well as cost per ton for hauling and disposal. Total tons in FY05 amounted to 60,835 at a rate of \$60.98 per ton. In FY07, total tons were 55,953 at a rate of \$62.86 per ton. Mr. Havens also provided the most recent waste composition study data from 2003. The categories used in the Key West study varied from the categories in the CACP software; Wesley Look and ICLEI staff were consulted to extrapolate the composition breakdown into the proper categories required by the software.

<u>Key West waste composition</u>		<u>CACP Software waste composition</u>	
31.1%	Wood/yard waste	31.1%	Plant Debris
24.5%	Paper	24.5%	Paper
11.5%	Plastic	0%	Food Waste
9.7%	Glass	6.3%	Wood/Textiles
8.1%	Metals	38.1%	Other:
5.7%	Other (furniture, appliances)		11.5% Plastics
4.1%	Misc. (Fines, Dirt, etc.)		9.7% Glass
3.3%	Clothes/Textiles		8.1% Metals
2.0%	Consumer Goods		2.7% Other (construction, etc.)
			2.0% Consumer Goods
			4.1% Misc. (Fines, Dirt, etc.)

### **Landfill Data**

The Florida Department of Environmental Protection (FDEP) was consulted to gather data on the history of the Stock Island landfill closing, and any measurements related to composition and estimated GHG emissions. R.B. Havens was also consulted. These inquiries led to contact with Bo Bruner from CH2MHill, the engineering company which oversaw the closing of the landfill in 1992-1994. According to Mr. Bruner and his colleagues, the methane emissions from the Stock Island landfill in 2005 are calculated as 374 US tons (340 metric tons) per year. Additional emissions of 1,026 US tons (933 metric tons) of CO<sub>2</sub> were also calculated.

Calculations were done using the USEPA LandGem model (v. 3.02), using the default parameters: k = 0.05/yr, Lo = 170 cu m/Mg, and assumed 50% methane, 50% CO<sub>2</sub> by volume.

### Community Indicator Data

All measurements of CO<sub>2</sub>e emissions are measured in US tons, or “short tons.” The US EIA and other agencies report units in metric tons. 1 metric ton CO<sub>2</sub> = 1.1023 short tons.

### Community Forecasting Data

Growth multipliers for fuel and electricity consumption projections reflect regional trends.

Forecasts for the residential, commercial, and transportation sectors for electricity, diesel and gasoline, are based on U.S. Department of Energy projections found in the Regional Energy Consumption and Prices by Sector report published by the Energy Information Administration available at

<http://www.eia.doe.gov/oiaf/aeo/supplement/supref.html>. This report provides information on anticipated energy use by sector for each year between 2005 and 2030. Table 5 for the South Atlantic Region applies to Key West. Using 2015 as the target year, a calculation of per capita change per year was made between 2005 and 2015 in the following sectors; the total change was divided by 10 to achieve an average yearly per capita change.

<u>Sector</u>	<u>Avg. Annual % change</u>
• Residential Electricity	0.64%
• Commercial Electricity	1.34%
• Gasoline	-0.36%
• Diesel (called “distillate fuel”)	1.0%

These figures were entered into the forecast builder in the CACP software in order to calculate forecasted emissions by the target year of 2015.

Community solid waste was forecasted using the *Solid Waste Rate Study Projections of Tonnages* report provided by R.B. Havens from Public Works. The projections provided were for FY08 through FY28. The projections indicate an 1% increase per year between FY08 until FY14, which goes down to .68%, for one year from FY14 to FY15. However, we accounted for the actual decrease in tonnage between FY05 tonnage and FY07 tonnage. Total tons projected by 2015 are 62,674, a difference of 1,839 tons over the baseline tonnage of 60,835. This averages to a 0.298% annual increase which was used as the forecast figure entered into the CACP software.

### D-2 Municipal Inventory Assumptions/Calculations

#### Municipal Electricity Data

The information used to estimate annual consumption of electricity and natural gas by municipal facilities was derived from Excel spreadsheets provided by the city’s Finance Department and Keys Energy Services. The spreadsheets provided by the city contained approximately 162 electric accounts paid by the city and indicated costs of the accounts but not consumption (kWh.) Keys Energy Services Finance Department provided spreadsheets which included consumption and costs for some 219 accounts. Inquiries to determine why this discrepancy existed were difficult to answer. Keys Energy Services had many accounts which they allocated to the city but which did not pass through the Finance Department. It appears that these accounts are primarily for buildings owned by the city which are leased to other agencies or entities. Keys Energy Services surmised that they were set up under the city’s jurisdiction to

avoid set-up and connection fees, of which the city is exempt. The city Finance Department had no awareness of these accounts.

Many electric accounts had duplicate or non descript names for the service location and function of the account, making it difficult to allocate them to different city departments and uses. Some, such as the sewage treatment plant and traffic lights were discreet accounts and easy to identify. Others, such as old fashioned street lighting and port facilities, were not clearly identified. Department heads and staff were consulted, but accounts remain that are not specifically identified. Department staff does not oversee energy consumption or billing for facilities in their department; all bills go directly to Finance. Therefore, department staff were unfamiliar with accounts and electric meters.

A best attempt was made to allocate the bills to different departments or uses based on the information available. The Buildings sector includes actual department facilities as well as area lighting at Key West Bight, Mallory Square and Garrison Bight. Its total electricity consumption in FY05 was 5,125,423 kWh. Streetlighting totals likewise were difficult to allocate in some cases. The streetlight sector includes all overhead streetlights, other lighting such as old fashioned streetlights, traffic lights, and park lighting. The total consumption for this sector in FY05 was 3,783,806 kWh. Electricity used in Water/Sewage divisions amounted to 5,801,250 kWh.

#### **Municipal Vehicle Fleet Data**

Total vehicle fleet gasoline and diesel consumption and cost was collected from fuel purchase records maintained by Margaret Scanlan in the Finance Department. To determine a breakdown by vehicle type, Steve Schipper from Fleet provided a list of vehicles and fuel use. Steve indicated which vehicle type category applied to each vehicle based on the CACP software categories of: Full Size (FS), Midsize (MS), Sub Compact (SC), Light Truck/SUV (LT), Heavy Truck (HT), Motorcycle (MC), and Transit Bus.

These records were only available for FY07 due to Hurricane Wilma in Oct. 2005 and the destruction of the TRAK computer system used to track this data. Therefore, a “backcast” was performed to estimate FY05 consumption by type. According to Finance records, there was a total fuel consumption decrease of 11.5% for vehicles other than transit. This decrease was applied for each vehicle type percentage (except transit bus) to achieve the estimate for FY05, as follows:

<b>Gasoline</b>	<b>06-07 gals</b>	<b>04--05 gals *</b>	<b>Diesel</b>	<b>06-07 gals</b>	<b>04--05 gals*</b>
<b>FS</b>	37,864	42,275	<b>FS</b>		
<b>MS</b>	5,439	6,073	<b>MS</b>		
<b>SC</b>	3,084	3,443	<b>SC</b>		
<b>HT</b>	1,289	1,439	<b>HT</b>	19,926	23,033
<b>LT</b>	62,621	69,916	<b>LT</b>	4,905	5,668
<b>MC</b>	439	490	<b>MC</b>		
			<b>Transit**</b>	128,630	80,591
<b>Totals</b>	<b>110,735</b>	<b>123,635</b>	<b>Totals</b>	<b>153,461</b>	<b>109,292</b>

\* based on 11.65% decrease in total fuel use from 05 to 07

Finance was able to provide actual fuel consumption for the transit fleet for both FY05 and FY07, so actual figures were used rather than the backcast estimate of the other vehicle types. The large increase in transit fuel is due to the expansion of the transit system from Key West to Marathon which began in October, 2005. Myra Hernandez, Director of DOT, provided information on the transit history.

Average yearly cost for gasoline and diesel was provided by Margaret Scanlan. In FY05, average gasoline cost was \$2.66 per gallon and diesel was \$2.53 per gallon. In FY07, gasoline was \$2.64 and diesel was \$2.82.

Off-road vehicles and equipment such as lawnmowers and backhoes were considered in the “heavy truck” category, per recommendations by ICLEI support staff.

### **Municipal Waste Data**

R.B. Havens, Director of Public Works, provided details on municipal waste. The figure for non-billable tons was allocated to government operations, which includes waste from government facilities, city cans, street sweeping and debris removal, and trash collected by city trucks, including special events. In FY05 the total non-billable tons amounted to 11,759 and in FY07 it was 13,063 tons.

## APPENDIX E

### *CACP Software Reports*

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